REPORT

OF THE

COMMISSION APPOINTED TO INVESTIGATE

THE EXISTING SYSTEMS

OF

MANUAL TRAINING

AND

INDUSTRIAL EDUCATION.

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ERRATA.

Page 233. — For "Boston Manual Training Course," read Boston Manual Training Course for Primary Grades.

Page 244. — Omit note, and for "Cookery Lessons," read Cookery Lessons, by Miss Ellen H. Duff, teacher in Boston School Kitchens.

Page 248. — In line 22, for "chimney," read oven.

Page 251. — In line 9, for "(1) Air, warmth, moisture and something sweet," read (1) Air, warmth, moisture, something sweet and something nitrogenous.

Page 251. — In line 39, for "CO," read CO_2.

Page 270. — Title should read as follows: Appendix N. Reports to the Commission of Visits of the Chairman to Various Manual Training Schools. — Rules and Regulations of Addison Street Industrial School. — Monograph on Domestic Economy, by Mrs. Ellen H. Richards. — Photographs of Manual Training Courses, as described on page 313.

Page 270. — "Equipment and Cost of Cookery School" should be in Appendix M.

Page 271. — "Equipment and Cost of Kindergarten and Sewing School" should be in Appendix M.

REPORT.

To the Honorable the Senate and the House of Representatives of Massachusetts.

The Commissioners appointed to investigate the existing systems of manual training and industrial education, and to report the results of their investigations with such recommendations as may seem best to them, respectfully submit their report.

The General Court of the year 1891 passed the following resolve: —

Resolved, That the governor appoint a commission, to consist of three persons, who are hereby instructed to investigate the existing systems of manual training and industrial education, with special reference to the question whether any existing system of manual training or industrial education, or any modification thereof, can be adopted with advantage in any of the public schools of this Commonwealth. The commissioners herein provided for shall serve without compensation, but shall be allowed for all expenses actually incurred in the performance of their official duties such a sum as the governor, with the advice and consent of the council, shall approve, which shall be paid out of the treasury of the Commonwealth; and they shall report the results of their investigations, with such recommendations as may seem best to them, to the next general court. [*Approved June 9, 1891.*

In July, 1891, His Excellency Governor William E. Russell appointed as members of the Commission Mrs. Louisa P. Hopkins, Mr. Edwin P. Seaver and Mr. George E. McNeill, who qualified soon afterwards, and held their first meeting in August.

Mrs. Hopkins was made the chairman and Mr. Seaver the secretary of the Commission.

A plan of work, readily suggested by circumstances, was marked out and adopted. The field of investigation was divided among the members in a manner to suit the individual interest, experience and opportunities for observation of each one; but all information gathered and conclusions formed by each were to be submitted to the others for consideration before being adopted as matter for the final report. Thus the division of the field of investigation was not to imply a divided responsibility in regard to the recommendations ultimately submitted.

Mr. Seaver was given manual training for boys in high schools and in the older classes of the grammar schools. To Mrs. Hopkins was assigned for investigation the manual training for both boys and girls in kindergartens, in primary schools and in the younger classes of the grammar schools; also manual training for girls — including particularly sewing, dressmaking and cooking — in the older classes of the grammar schools; also industrial training in the so-called "vacation schools." A consideration of the whole subject as related to labor interests and to the social and industrial questions of the day was committed to Mr. McNeill.

Meetings of the Commission were held for the purpose of taking the testimony of persons whose special knowledge and experience would aid the Commissioners in reaching the best conclusions. The more interesting and important parts of this testimony are printed in the Appendices to this report. (See Appendices I, J and K.)

The work of collecting books, reports and other printed matter relating to manual training; of corresponding with teachers, officials and other persons practically engaged with the subject; and of visiting schools in which the new instruction could be witnessed in actual operation, — was carried on, so far as the time at the command of the several Commissioners permitted, during the last four months of the year 1891. But it became evident before the beginning of the General Court in 1892 that an adequate report could not be made in due season. The Commissioners felt unprepared to

meet even their own moderate expectations, — to say nothing of doing full justice to the large subject that had been intrusted to their consideration. Their investigations had been far too limited, and were still unfinished.

A sufficient reason for this failure to be ready at the appointed time with a complete report was to be found in the fact that the Commissioners were very busy persons, who could command, aside from their regular duties, only the odds and ends of their time for the work of the Commission.

Feeling that this reason would be recognized, the Commissioners decided to make a brief report of progress, and to suggest that the time for rendering a final report be extended one year. The committee on education, to whom this suggestion was made, reported thereon favorably, and the following resolve was passed: —

Resolved, That the commissioners appointed to investigate the existing systems of manual training and industrial education, in accordance with the provisions of chapter one hundred and six of the resolves of the year eighteen hundred and ninety-one, be instructed to continue said investigation, and report the results thereof, with such recommendations as may seem best to them, to the next general court. The commissioners shall serve without compensation, but for expenses actually incurred in the performance of their official duties the sum of one thousand dollars, in addition to that already appropriated, shall be allowed and paid out of the treasury of the Commonwealth. [*Approved May 17, 1892.*

The Commissioners have pursued their inquiries down to the present time, and now submit a final report, with such recommendations as have seemed best.

PART I.

By EDWIN P. SEAVER.

The Recent History of Manual Training and Industrial Education.

The two phrases "manual training" and "industrial education" are often used the one for the other, as if they denoted the same thing. In a general way they do suggest the same thing, yet under different aspects, and with some meaning attached to each not carried by the other. Thus the *occupations* of the kindergarten and the *hand-craft* taught to young children in the schools are not most aptly described as *industrial* education; nor, on the other hand, would the instruction given in a trade school or in apprenticeship be fully covered by the term manual training; and yet there is in all such instruction, from that given the youngest to that given the oldest pupils, much that is identical in purpose and in effect.

Recognizing this identity, we may nevertheless conveniently observe a certain distinction between the phrases in question; understanding by *manual training* any instruction in manual work designed to improve the intellectual powers of the worker, and by *industrial education* the instruction necessary to produce the kinds and degrees of skill needed for the exercise of particular trades or industries.

These two purposes, the one educational and the other economic, are clearly not inconsistent with each other in theory, nor does one exclude the other in practice. Both can be and are subserved by the same school or by the same course of instruction. For example, there is good intellectual training to be had in the learning of trades for purely industrial ends, if the methods of instruction be logical and well adapted to their purpose. On the other hand, the industrial value of manual training is not to be ignored

merely because its chief aim happens to be the development of general intellectual power. Indeed, it may be observed that most of the existing systems of manual instruction exhibit a double purpose, partly educational and partly economic, the one or the other predominating, according to the ages or other circumstances of the pupils. So, too, among the arguments that have been advanced in support of manual training as a branch of public instruction there are some which allege its disciplinary value and others which lay stress on its industrial utility. There is good ground for both these lines of argument, the validity of neither impairing that of the other.

The educational theory sought to be realized through manual training is no new theory, nor is it now for the first time engaging general attention. It has been a theme with educational writers from Luther and Comenius down to the present time, and there are to be found in the books frequent passages which recognize the value of manual work in the education of youth, — even of youth whose situations in after life would preclude their using their acquired skill for industrial ends. Thus has the learning of trades been prescribed in the education of princes. Rousseau would have Emile learn a trade, that his pupil might acquire a more valid title of nobility than any he might inherit from ancestors. Pestalozzi resorted to manual training with the vagabond children he collected in his schools, believing it to be one important means of educating the poorer classes. Locke, in writing of the education of gentlemen's sons, pointed out some practical advantages to be gained from manual work by boys passing through the usual course of book instruction; the chief of which were the promotion of bodily health by physical exercise and the mental relaxation brought about by change of employment. But in the writings of Froebel may be found the most satisfactory statement of the reasons for regarding manual training as an essential factor in the right education of all children.

Froebel's idea was that of a full, all-sided education, reaching every element of the child's being, utilizing every wholesome influence from his surroundings, and leading him ultimately to clear knowledge and conscious efficiency in all relations of life.

For this purpose all ranges of thought and feeling were to be opened, and all impulses to activity brought under the intelligent and orderly control of the will. Even the spontaneous play of childhood might under proper guidance accomplish definite educational results. Hence the kindergarten, the games and occupations of which early brought the child into intelligent sympathy with the busy human life going on around him. Later came positive instruction in the occupations of the household, the garden or the field, and in the trades of the workshops. The instructor in these things might be either the parent or the school teacher, and the place might be at home or in school; but in either case the process and the result were to be counted as educational, no less than were the study and mastery of book knowledge to be so counted. And the reason, stated in Froebel's words, was that "lessons through and by work, through and from life, are by far the most impressive and intelligible, and most continuously and intensely progressive both in themselves and in their effect on the learner. Notwithstanding this, children — mankind, indeed — are at present too much and too variously concerned with aimless and purposeless pursuits, and too little with work. Children and parents consider the activity of actual work so much to their disadvantage, and so unimportant for their future conditions in life, that educational institutions should make it one of their most constant endeavors to dispel this delusion. The domestic and scholastic education of our time leads children to indolence and laziness; a vast amount of human power remains undeveloped and is lost. It would be a most wholesome arrangement in schools to establish actual working hours similar to existing study hours; and it will surely come to this."*

Again in another place he says: "For boys of this age should have some definite domestic duties to perform. They might even receive regular instruction from mechanics or farmers, such as has been frequently given by fathers inspired by vigorous and

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* Quoted from "The Education of Man," by Friedrich Froebel, translated by W. N. Hailmann, New York, 1887. The original book was first published in 1826. It was the first volume of a proposed work which was never finished.

active natural insight. . . . It is very desirable that such boys should devote daily at least one or two hours to some definite external pursuit, some externally productive work. It is surely one of the greatest faults of our current school arrangements, especially of the so-called Latin and high schools, that the pupils are wholly debarred from outwardly productive work. It is futile to object that the boy at this age, if he is to reach a certain degree of skill and insight, ought to direct his whole strength to the learning of words, to verbal instruction, to intellectual culture. On the contrary, genuine experience shows that external, physical, productive activity interspersed in intellectual work strengthens not only the body but in a very marked degree the mind in its various phases of development, so that the mind, after such a refreshing work-bath (I can find no better name), enters upon its intellectual pursuits with new vigor and life." *

Froebel enumerates the subjects of the educational life of home and school, and groups them "in accordance with the inner needs of boyhood into subjects (*a*) of the more quiet, calm, inner life; (*b*) of the more receptive, intro-active life; (*c*) of the more expressive outwardly formative life." † It is this last and not least important phase of boyhood that manual training provides for. To neglect this, as is too often done, is to leave the education of boyhood one-sided and incomplete.

The practical realization of Froebel's educational ideas in the kindergarten has made his name well known in all enlightened nations. What is not so well known, perhaps, is the fact that to the influence of his writings is due the introduction of hand-craft in the elementary schools of Finland and Sweden, where it is known as slöjd (sloyd), and whence, of late, it has spread to Denmark, Belgium, Germany, Austria, Switzerland, England and the United States.

Had Froebel been permitted to finish his great work, "The Education of Man," it is highly probable that the education of boyhood and of youth would have been worked out by him with the same attention to details and the same practical wisdom which

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* "The Education of Man," page 236. † "The Education of Man," page 237.

characterized his works on the kindergarten; and that, consequently, his authority might have become no less commanding for the later than it has become for the earlier years of the educational period of life. But even in his unfinished work we may find the whole substance of the doctrine which supports the modern demand for manual training as a purely disciplinary pursuit.

Briefly stated, his doctrine is that the human mind is creative as well as acquisitive; that the child's mind cannot be developed according to the laws of its growth unless the creative activities be brought under systematic training in at least equal measure with the acquisitive powers; and that both disciplines should be continuous from the earliest to the latest stage of education. A scheme of education which concerns itself with the acquisitive powers merely — and this has been the usual scheme of the schools hitherto — is fatally one-sided and partial. The needed reform consists in providing adequately for the creative activities. Therefore there should always be among the disciplines of school and home systematic exercises in the translation of thought into action, of inner mental ideas into outward material representations. For, in the language of Froebel, "Man is developed and cultured toward the fulfilment of his destiny and mission, and is to be valued, even in boyhood, not only by what he receives and absorbs from without, but much more by what he puts out and unfolds from himself. Experience and history, too, teach that men truly and effectively promote human welfare much more by what they put forth from themselves than by what they may have acquired. Every one knows that those who truly teach gain steadily in knowledge and insight; similarly, every one knows, for Nature herself teaches this, that the use of a force enhances and intensifies the force. Again, to learn a thing in life and through doing is much more developing, cultivating and strengthening than to learn it merely through the verbal communication of ideas. Similarly, plastic material representation in life and through doing, united with thought and speech, is by far more developing and cultivating than the merely verbal representation of ideas." *

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* "The Education of Man," page 278.

To Froebel's doctrine and the zeal of his followers in applying it we undoubtedly owe manual training as we now have it in the kindergarten and the primary schools. To the same cause may be attributed the efforts now making to extend manual training, by means of the Swedish sloyd or other similar exercises, upwards toward the high school. Indeed, it is easy to see that Froebel's principles, carried to the full extent of their application, would bring manual training not only up to the high school but through it and even beyond. Nevertheless, we must look elsewhere for the immediate causes of the welcome which manual training, as a discipline for boys of high-school age, has received of late years in the United States.

The manual training which has been given place in our boys' high schools during the last twelve or fifteen years has a definite character and purpose, because originally it was designed to meet a specific educational want. It may be described as a *course of instruction in the mechanic arts;* and it is to be distinguished on the one hand from apprenticeship and trade-school instruction, and on the other hand from the manual training of young children. It does not aim at the teaching of any one trade, nor does it impart a merely superficial acquaintance with many trades; but it gives a thorough course of instruction, both theoretical and practical, in the principal operations of all mechanical trades. These *principal operations of the mechanical trades* are what the term *mechanic arts* denotes. These are few, while the trades in which they find their applications are many; therefore the "mechanic arts," and not "trades," are the proper foundation for a course of instruction having an educational purpose. Neither is such a course adapted to the strength of boys under the high-school age, — fourteen or fifteen years, — because it is the work of men, and was designed for the instruction of young men.

The young men for whom this method of instruction in the mechanic arts was first devised were students in civil and mechanical engineering. These students needed objective practical instruction in the principles of the trades with which as engineers they would have to do. The abstract and theoretical instruction usually given was insufficient, and often left the engineer in an

awkward position of inferiority relatively to the skilled workmen under his direction. To attempt to gain this practical knowledge by learning all the trades in the ordinary way of apprenticeship would consume far too much time, and might, as experience had shown, leave the principles obscured in multitudinous and complicated details. What needed to be done was just what had been done with other arts and sciences in order to make them fit subjects for intellectual discipline; namely, to separate principles from details, basing instruction exclusively on the principles, and retaining only enough of the details to serve the purposes of illustration. To do this and at the same time to make the instruction objective and practical was nothing more nor less than applying to the mechanic arts the laboratory (workshop) method of instruction, — a method which has revolutionized instruction in chemistry, physics and other sciences within the last forty years.

It was in the Imperial Technical School at Moscow, Russia, that this laboratory method of instruction was first successfully applied to the mechanic arts. "In 1868," says M. Victor Della-Vos, the director, "the school council considered it indispensable, in order to secure the systematical teaching of elementary practical work, as well as for the more convenient supervision of the pupils while practically employed, to separate entirely the school workshops from the mechanical works in which the orders from private individuals are executed, admitting pupils to the latter only when they have perfectly acquired the principles of practical labor. By the separation alone of the school workshops from the mechanical works, however, the principal aim was far from being attained. It was found necessary to work out such a method of teaching the elementary principles of mechanical art as, firstly, should demand the least possible length of time for their acquirement; secondly, should increase the facility of the supervision of the gradationary employment of the pupils; thirdly, should impart to the study itself of practical work the character of a sound systematical acquirement of knowledge; and, fourthly and lastly, should facilitate the demonstration of the progress of every pupil at every stated time. . . . In the year 1870, at the exhibi-

tion of manufacturers at St. Petersburg, the school exhibited its method of teaching mechanical arts, and from that time they have been introduced into all the technical schools of Russia. . . . And now [at the Paris Exposition in 1878] we present our system of instruction, not as a project, but as an accomplished fact, confirmed by a long experience of ten years of success in its results." *

Two years before the Paris Exposition, at Philadelphia in 1876, M. Della-Vos had exhibited substantially the same system of mechanic arts instruction, showing the tools and illustrating the exercises by complete series of students' shop work. There were men with receptive minds at Philadelphia, for in America as well as in Russia had been felt the want of a scientific method of teaching the mechanic arts in technological schools. Among others, Prof. John D. Runkle, at that time president of the Massachusetts Institute of Technology, saw and studied this Russian exhibit. Immediately on his return home he recommended to the corporation of the Institute that the courses in civil and mechanical engineering in that institution be completed by adding to existing provisions a series of instruction shops, in which should be taught all the mechanic arts which young engineers needed to learn. By vote of the corporation, Aug. 17, 1876, the department of the Institute since known as the School of Mechanic Arts was established. The same step was taken a little later, June 6, 1879, by Washington University in St. Louis, at the suggestion of Prof. C. M. Woodward of the engineering department in that institution. These two examples were soon followed by other scientific and technological schools in different parts of the country. Many of these latter institutions had recently come into existence in the several States through the aid afforded by the land grant act of Congress, passed in the year 1862, for the

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* Quoted from a valuable paper by Prof. John D. Runkle, on "The Manual Element in Education," printed in the forty-fifth annual report of the Massachusetts Board of Education, page 138. This paper gives a full description of the Mechanic Arts School in the Massachusetts Institute of Technology; also some account of the Imperial Technical School at Moscow, and of some other European schools of a similar character.

purpose of aiding the States to establish colleges in which should be taught agriculture, the mechanic arts and military drill. Speaking generally, the instruction in agriculture had been carried on in these institutions with encouraging success; but the same could hardly be said of the instruction in the mechanic arts. This had not emancipated itself from bondage to details, had not advanced beyond miscellaneous trade learning. The Russian method of shop instruction came, therefore, as a promising solution of a most troublesome problem. As such it has been welcomed and appreciated; and it has spread widely among the technological and scientific schools (including the agricultural colleges) of the country since its first introduction at Boston and at St. Louis.*

This first step was followed soon by a second. The shop instruction designed for young men, students of engineering, was at once seen to be well suited to the powers, mental and physical, of high-school boys. Moreover, the new discipline, aside from its special advantages in the technical education of engineers, was believed to possess great value as an element in general education. By uniting with it a thorough course in free-hand and mechanical drawing and good courses in language and in science, a very

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* If it were the purpose of this report to give a full history of mechanic arts instruction in the higher educational institutions of this country, ample notice would be taken of the Worcester Polytechnic Institute. In this institution has been carried on for many years with success a system of mechanic arts instruction which differs in some important particulars from that above referred to as the Russian shop instruction. In the first place, all the work of the students, save a few preliminary exercises, is upon things intended for sale in the market. A knowledge that his work is to be brought to the merciless test of commercial valuation acts upon the student as a strong and wholesome stimulus. In the second place, the students are given only the operations, the tools and the machinery which would be found in the best commercial machine shops of the present day. The following extract from the last annual catalogue presents these points clearly: —

"The buildings contain engine room, engine and boilers, blacksmith shop, tool room, draughting room, painting and finishing room, and large work rooms, for both wood and metals, fully equipped with tools and machinery. Here the students in mechanical engineering spend their practice hours as apprentices, and it is found that the graduates in this department are as skilful mechanics as ordinary apprentices who have served three years in a shop, and they have in addition the advantage of a solid education. This result is attained under the following conditions: —

"1. These shops are organized and managed as a manufacturing establishment, and a great variety of work is always in process of construction, in order that the student may constantly have the wholesome atmosphere of real business. This, with a determination on the part of the superintendent to maintain a high standard

desirable high-school curriculum could be marked out which should prepare boys either for higher courses in science and technology or for the general business of life. Both the School of Mechanic Arts in the Massachusetts Institute of Technology and the Manual Training School in Washington University early began to receive boys of high-school age for the purpose of demonstrating the value of such a curriculum. The Institute of Technology, however, discontinued its experiment after a few years, not because it was thought to have failed, but because the trustees were convinced that high-school instruction in any form was a matter quite outside the range of their chartered powers. Besides, had the case been otherwise, there were not likely to be many parents who would willingly pay a high tuition fee, one hundred and fifty dollars a year, in a city where excellent high-school instruction could be had for nothing. Of late, therefore, the School of Mechanic Arts has been held strictly to its original purpose, that of giving workshop instruction to students of engineering.

Not so with the Manual Training School at St. Louis. That was established on an independent basis; and it has gone on with increasing success, as a boys' high school of the new type, pre-

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of workmanship, has made the progress of the students in the best methods of construction both rapid and thorough, and has proved the most effective means for giving them an exact knowledge of shop practice.

"2. The work of each student is done under the personal supervision and direction of a skilled workman, and with the advantage of the best obtainable tools and machinery; for it is as true in handicraft as in the training of the intellect that the best tools and appliances are not too good in instruction.

"3. Every student receives training in drawing during the entire course. In this way exact knowledge of form and proportion is secured, and the students make more intelligent and satisfactory progress in the shop than is possible for those who have not had advantage of this training. Besides the general training in free-hand and instrumental drawing, students in this department have practice during senior year in making working drawings of machines, and determining the strength, dimensions and proper proportions of machines from numerical specifications.

"4. The weekly practice is distributed so as to occupy five hours each of two days. Each student is required to render a strict account of these hours. The time thus spent serves the double purpose of practice and exercise.

"5. Each student advances as fast as possible, unchecked by the difficulties of his neighbors, or any business necessity of the shop."

It is still a mooted question whether the products of mechanic arts instruction should be broken up for kindling wood and junk, as is usual when they are mere exercises, or should be sold in the market. The experience at Worcester seems strongly to support the latter conclusion.

paring its pupils not only for higher courses in science and technology, but also for commercial and industrial pursuits. It has become the model for many similar schools in all parts of the country. Its general character and purpose are set forth in the following language, quoted from the ordinance by which it was established: "Its object shall be instruction in mathematics, drawing, and the English branches of a high-school course, and instruction and practice in the use of tools. The tool instruction, as at present contemplated, shall include carpentry, wood-turning, pattern-making, iron chipping and filing, forge work, brazing and soldering, the use of machine-shop tools, and such other instruction of a similar character as may be deemed advisable to add to the foregoing from time to time. The students will divide their working hours as nearly as possible equally between mental and manual exercises. They shall be admitted on examination, at not less than fourteen years of age, and the course shall continue three years."

The number of schools which have been established on this plan of instruction or have changed to this plan by adding to their former courses the mechanic arts course has become large during the last ten years, and is still increasing. Indeed, the rapid multiplication of such schools constitutes one of the most remarkable educational phenomena of the present time. No complete list of these schools has been made; but we shall here mention and briefly describe some of the more important ones.

In January, 1884, the Commercial Club of Chicago established and endowed the Chicago Manual Training School. This school, like its St. Louis prototype, receives substantial tuition fees from its students; but, unlike it, has no connection with a university. Some of its graduates pass to higher institutions, and some into commercial or industrial life. The school has flourished from the beginning; and its success has led to the establishment of other schools of the same kind in Chicago, one by the Board of Education as a public high school, another by the wealthy Hebrews for boys of their race, and still another by Mr. Armour.

While the merchants of Chicago were taking action in that city, the same year and month, January, 1884, the city council of

Baltimore established the Baltimore Manual Training School. This is a free public school, supported wholly by public taxation, and is the earliest school of its kind in America.

In the same year, too, 1884, the city of Toledo made use of a certain trust fund for the purpose of establishing manual training in connection with the public high school in that city. A large wing was added to the high-school building, containing instruction shops not only for boys to work in wood and metals at bench and machine, but also for girls to work at wood-carving, cooking, sewing and dressmaking. This seems to be the earliest instance of industrial education for girls in a public high school. The boys and girls who took the instruction in these new subjects took it as a clear addition to their regular high school work; but they did it with enthusiasm, and the effect was to interest them more than formerly in the school. Observation through several years has ascertained the fact that many boys and girls remain in school, who, without opportunities for such instruction, would have dropped out. The girls shared with the boys the work in drawing, in wood-carving and in light joinery, but later in the courses they separated.

The Cleveland Manual Training School originated in a small class in carpentry, started in February, 1885, by a teacher of physics in the Cleveland High School, Mr. Newton M. Anderson, for the benefit of some of his pupils in the high school. The time taken was in the afternoon, and the place was a barn. "Through the diligence and enthusiasm of these boys, this little school and the value of manual training were brought to the notice of some of the business men of the city. One or two meetings were held at which the question of the establishment of a manual training school in Cleveland was thoroughly discussed. It was decided to form a stock company with a capital of twenty-five thousand dollars, with which money to erect and equip a building, and to charge a tuition fee just sufficient to cover running expenses." This building was opened in 1886, and pupils came there from the high schools of Cleveland. This arrangement continued till 1892, and the school was known as the Cleveland Manual Training School. It is now discontinued, because the

Board of Education of Cleveland, having permanently established manual training courses in both the high schools of that city, has no further use for temporary accommodations. Meanwhile, Mr. Anderson has secured the endowment for and established a large and prospering private institution in Cleveland, named the University School. This school combines the features of a classical high school and of a manual training school, and is designed to give the broadest possible education to its pupils. It constitutes one of the most noteworthy and interesting experiments yet made in the new higher education of boys.

The Philadelphia Manual Training School, established in 1885, is, like the one at Baltimore, a free public high school, supported wholly by the public taxes. It has complete courses in the mechanic arts, in drawing and in the usual book studies of a high school. The authorities in Philadelphia believed it was better to set up a separate and independent school of this kind than to add courses in the mechanic arts to the work of existing high schools. That this school has successfully met an actual want is indicated by the fact that Philadelphia has recently (1892) established a similar school in another quarter of that city.

Girard College early adopted mechanic arts instruction, on a plan devised for that institution by Professor Runkle. The motive was to provide a substitute for apprenticeship, which had so far fallen into disuse in Philadelphia that it had become exceedingly difficult for the college authorities to place their boys where they might learn mechanical trades. The trustees of Girard College declare in one of their reports that the Russian system of shop instruction came to them as a most welcome and satisfactory solution of a very embarrassing problem.*

The magnitude of the difficulty will be the more readily appreciated when we remember that the college has enrolled twelve

* "Our introduction of this mechanical instruction seems almost providential, in view of the scarceness of apprenticeships. Up to almost the end of the year 1884 metal work alone was taught, and during that year only about one-third of the boys who left college entered into mechanical pursuits; but of those who left during the year 1885, and since instruction in ordinary wood work and turning has been introduced, two-thirds have obtained work in mechanical occupation."

hundred or more boys, ranging in age from ten to eighteen; and that boys on reaching the age of eighteen are not permitted by the charter to remain longer in college, but must be "bound out as apprentices." The effectiveness of the mechanic arts instruction now given in Girard College may be estimated from the fact, which we have taken pains to verify, that boys of eighteen who have had that instruction ten hours a week for two years are, as a rule, credited with two full years of time when they enter the machine shops at Philadelphia; so that they are placed on the same level with other boys who have worked in the shops two years the full time, say fifty hours a week. Thus it appears that the instruction of the mechanic arts school *ten hours a week* is equally effective with the instruction obtained in the ordinary apprenticeship of the shops *fifty hours a week*. In other words, the mechanic arts school is better than apprenticeship in the shops in the ratio of *five* to *one*. And this is the judgment, not of theorists nor of sentimentalists, but of hard-headed business men.

Many of the promoters of manual training for boys have been at pains to emphasize the fact that their schools do not teach trades. While this is true, it is also true that their schools do bring their pupils a long way on towards the learning of many trades. And this is because the instruction is based on the principles underlying the trades, not on the details of the trades themselves. It is the result of applying the science of education to the learning of trades.

Another school of the St. Louis type is the Cincinnati Technical School, founded in 1886; another, the Manual Training School of Denver University; and still another, the Tulane High School, connected with Tulane University in New Orleans. Of the Baltimore and Philadelphia type are schools in Wilmington, Del., and in Providence, R. I.

The list of cities in which manual training has been added to the work of existing high schools includes New York, Albany, Eau Claire, Omaha, Carson City, Washington, Indianapolis, St. Paul, Minneapolis and many others.

In Massachusetts we have the Manual Training School at

Cambridge, the gift of Mr. Frederick H. Rindge of California, who offered to his native city " an industrial school building ready for use, together with a site for the same." This school, like that in Toledo and the first one in Cleveland, is an auxiliary to the public high school, receiving pupils therefrom at stated hours for instruction in the mechanic arts and in drawing, but itself giving no instruction in book studies. The high schools in Fall River and in Springfield have established manual training in their courses.

Among the proposed high schools of the new kind may be mentioned the Mechanic Arts High School in Boston, the building for which is approaching completion,* and a new high school in Brookline, which, when organized, will afford an opportunity for the extension of the instruction now going on in the William H. Lincoln Grammar School in that town.

In all the schools thus far enumerated the course of instruction for the boys is substantially the same, namely, joinery, wood-turning, wood-carving, pattern-making, moulding, casting, forging, chipping, filing and machine-shop practice, together with drawing and the book work of the ordinary high-school course.

This course, however, should be described in minute detail, with suggestions as to the cost of necessary tools and equipment, if, as is proposed, it is to be made the basis of recommendations in this report. And this is the place in the report for such a description. It happens, however, that the writer was sent four years ago by the school committee of Boston to visit and carefully inspect most of the schools named above, that he might the better prepare himself to draw up a course of instruction and a plan of building and equipment for the proposed Mechanic Arts High School in that city. He is convinced that he could hardly do this work better now than he did it then. Therefore his " Plan for a Mechanic Arts High School," taken from the Boston school documents, has been placed in the Appendix to this report for the information of readers who may desire knowledge of the minute details of the subject. (See Appendix A.) The reader is also

* For the plans and a perspective view of this building, see Appendix A.

referred to the paper of Professor Runkle, already quoted from, in the forty-fifth annual report of the Massachusetts Board of Education, where will be found (pages 146–170) a full description with illustrations of the shop exercises used in the School of Mechanic Arts in the Massachusetts Institute of Technology. For wood-cuts illustrating the exercises used in the St. Louis Manual Training School, see Woodward's "Manual Training School." *

For a fully illustrated course of lessons in wood-work and in iron-work at bench and at machine, as given in the Pennsylvania State College, see the very valuable report of the Industrial Education Commission to the Legislature of Pennsylvania, 1889.

We have seen that manual training has a recognized place in the kindergarten, and that efforts more or less successful are making to carry it upward through the grades of the primary and grammar schools. We have also seen that manual training has been secured a place in the high-school instruction of the country. It remains to notice the efforts that have been made to connect the manual training of the high schools with that below, by working downward through the grades of the grammar schools.

These efforts have been made in two ways: first, by introducing the simpler wood-working exercises of the Russian system of shop instruction into the upper grades of the grammar schools; and, secondly, by introducing a system of wood-working which comes to us ready-made from Sweden, and is known as sloyd. It is obvious that the Russian system, which was designed for young men, must undergo important modifications to fit it for the use of city grammar-school boys. The Swedish sloyd, on the other hand, is already well adapted to the powers of young boys, because it is the outcome of long experience in Sweden, where it has been used to supply manual training for young boys in the elementary schools. The exercises of the Russian system, being rather difficult for boys under fourteen years of age, cannot easily be carried on in the lower classes of the grammar schools. The necessary modification, therefore, consists in substituting simpler

* Boston, 1887.

exercises for the more difficult ones, and then rearranging the whole so as to secure easy gradations and logical development. Only wood-working exercises with hand tools have, for the most part, been used in experiments with the Russian system in grammar schools. A noteworthy exception to this remark, however, occurs in the case of the William H. Lincoln school in Brookline, where the use of some wood-working machinery takes place in the grammar classes, and where, probably, some work with metals will be given to boys below the high-school grades.* But, speaking generally, we assume that the use of machinery with power is not likely to become extensive or even considerable among grammar schools. Neither does it appear probable that metal-work exercises will be largely adopted for the training of young boys.

The strong point in the Russian shop instruction lies in the emphasis it places on the working drawing. Every exercise must be worked from a drawing made by the worker himself; and, moreover, each worker must take, simultaneously with his courses in shop work, a thorough course in draughting. The weak point in the Swedish sloyd is its neglect of the working drawing. At least, this remark is true of the sloyd as it came to us from Sweden. There have been some changes in the system since it came into this country, so that we now hear frequent mention made of "American sloyd." The most important of these changes is the adoption of the working drawing. Other changes relate more to details than to matters of principle.

Both systems, the so-called Russian and the so-called Swedish, are now on trial in the grammar schools of Boston, and on quite a large scale; but it is too early now to report the results of that trial. The intention of the school committee of that city is understood to be to continue the experiment for perhaps two years longer, in expectation that there may be a clear demonstration from experience of the best means by which the wants of boys in city grammar

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* For an account of this school, by Professor Runkle, see Appendix B. Further information may be found in a report of the testimony given by the principal of the school, Mr. D. S. Farnham, Appendix C, and by Mr. Samuel T. Dutton, superintendent of schools, Appendix D.

schools can be supplied, whether by the Russian shop work or by the Swedish sloyd, or by some combination and outgrowth of the two, larger and better than either.

Another much-debated difference between the two systems is found in the nature of the exercises employed. By the Swedish system it is required that every piece of work shall be some completed and useful article; but in the Russian system little or no regard is paid to such a requirement, the pieces of wood-work in the early part of the course being merely so many specimens of carpenters' joints. Here, evidently, is matter for interesting discussion. But it does not lie within the purpose of this report to engage in such a discussion, for the reason, chiefly, that experience alone can demonstrate the superiority of this or that system, and experience in this country is hardly yet ripe enough to be conclusive.

What, however, our experience has proved appears to be that wood-working in some form or other, but chiefly with hand tools at the bench and without the use of much machinery, is a form of manual training well suited to the wants of boys in city grammar schools; that girls as well as boys can receive the instruction with excellent results; and that the instruction can be given by the regular teachers of the primary and grammar classes, after a suitable course of preparatory training, even though these teachers are women wholly inexperienced previously in the use of tools.

This last result has been not a little surprising to many, although enthusiastic sloydists claim that it is the most natural thing in the world. Either way, the result is equally welcome; for it goes far towards answering the question, Who will be the teachers of wood-working if that branch of instruction is to be generally adopted in the elementary schools? The point of this question lies just here: so long as a new branch of instruction, like wood-working, seems likely to require a corps of special teachers in addition to the regular teachers, and at considerable additional expense, people are likely to object to its introduction, or, if already in, to throw it out when economy is the cry; but if the regular teachers can do the work with no more assistance from experts than may be necessary at first to give them a preparatory training,

then the most serious ground for objection falls away. It is particularly interesting, therefore, to observe the fact that a considerable number of women, primary and grammar school teachers in Boston and other places, have taken the course of instruction in sloyd given by Mr. Larsson in Boston, and have since become teachers of sloyd to grammar-school children, — not only boys, but in some instances girls too.

The extent to which wood-working has been adopted in the elementary schools of the United States has not been precisely ascertained, because the information contained in printed reports is not always full and explicit enough to show just what is meant by the general statement that "manual training" has been "introduced into the public schools." Sometimes the meaning is merely that drawing has been made a part of the course of study; or that paper-folding, clay-modelling and card-board construction have been included in the primary school work; or that sewing has been taught to the girls. Again, the meaning may be that wood-working at bench and lathe, but not the full course in the mechanic arts, has been adopted in the high school or in the upper classes of the grammar schools. It is, however, certain that wood-working has been adopted more or less extensively in the grammar schools of Washington, D. C., New Haven, Conn., St. Paul, Minn., Montclair, N. J., New York City, Jamestown, N. Y., and of Boston, Brookline, Springfield, Northampton, Waltham and Salem in Massachusetts. It is also to be noted that the lively demand for good sloyd teachers indicates a wide-spread interest in the subject.

There are several State normal schools which, like that at New Britain, Conn., have adopted wood-working, not only that their pupils may understand the principles of manual training *as a method in education*, but also acquire the skill to construct the simple apparatus they may afterwards need in their teaching. Two normal schools in Massachusetts, that at Salem and that at Bridgewater, have done this. For a description of the course in the latter school, by the principal, Mr. Boyden, see Appendix E.

A good general idea of the wood-working now experimentally carried on in the grammar schools of Boston may be gathered from

the representations given in Appendix F. Plates I., II., III. and IV. show a graded course in wood-work, covering four years, drawn mainly from the Russian shop work. This course was arranged by Mr. Frank M. Leavitt, and has been taught by him for two or three years past in the Eliot School at Jamaica Plain. Plate V. shows the room with the benches and tools. Plates VI. and VII. show a four-years course in Swedish sloyd for grammar schools, taught by Mr. Gustaf Larsson at the Appleton Street School in Boston. Plates VIII., IX. and X. give views of the models chosen by Mr. B. F. Eddy for his course of instruction at the North Bennet Street Industrial School in Boston. Plate XI. shows the room with a class of boys at work; Plate XII., the class at drawing; and Plate XIII., the class gathered for a demonstration. Mr. Eddy has contributed a detailed statement of his manner of teaching the exercises illustrated by his models. (See Appendix G.)

For the lower classes of grammar schools something has been done in devising wood-working exercises suitable for young pupils. The "knife work" practised in the Springfield schools consists of exercises in cutting thin wood to prescribed forms and dimensions. The pieces are afterwards put together with glue or brads, to make various miniature articles or toys.* This same work has been done in the Lowell School in Boston, by boys in the two lowest grammar classes. It can be done in an ordinary school-room with no more change of equipment than merely placing a board cover on the top of the ordinary desk. The tools are few and simple.

Another course of wood-work for young grammar pupils is used in the schools at Northampton. Its author, Rev. Frederick A. Hinckley, has kindly furnished a description with illustrations, which will be found in the Appendix. (See Appendix H.) The chief merit of this course, aside from its simplicity, practicability and inexpensiveness, appears to be its close connection and coördination with drawing. It is in itself an admirable course in form study, carried on by the best of methods, that of form *making*.

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* For the whole course of wood-working, including the "knife work," in the Springfield schools, see Appendix I.

Thus far our report has dealt chiefly with manual training for boys. That for girls and for young children will be treated fully in another part. We conclude this part with a brief consideration of the question why it is that manual training has become so widespread and so popular during the last dozen years.

It is certain that the writings of educational philosophers have not kindled the existing interest in the subject, for these have been published and read for many years. Neither can we attribute much to the influence of educators, — meaning by this term the class of persons engaged in the practical administration of educational affairs, — because their opinions have been widely various. Some have been as conspicuous for opposing as others have for advocating this new discipline, while very many have remained uncommitted.

To some extent we may attribute the favorable reception manual training has had to its promise of becoming an acceptable substitute for apprenticeship, now fallen into merited disuse; or to its opening the way to industrial employments for the many whom circumstances now exclude; or to its great attractiveness for active boys; or to its excellence as physical exercise; or to its answering the somewhat vague demand for "something practical" in education; or to its inculcating "the true dignity of labor" and "respect for the laborer." Each of these causes has, undoubtedly, contributed something, and the total effect has been considerable. But there is a more powerful cause than any of these, or all of these together.

Among the deep-rooted convictions cherished by New England people and their descendants everywhere, none is more firmly held than this, — that learning how to work and forming habits of industry are indispensable elements in the right education of every boy or girl. This belief early found expression in the laws, as thus in Massachusetts in the year 1642: —

This Court, taking into consideration the great neglect in many parents and masters in training up their children in learning and labor, and other imployments which may bee profitable to the common wealth, do hereupon order and decree, that in every towne the chosen men appointed for managing the prudenciall

affaires of the same shall hencefourth stand charged with the care of the redresse of this evill, so as they shalbee liable to bee punished or fined for the neglect thereof, . . . and for this end they, or the greater part of them, shall have power to take accompt from time to time of their parents and masters, and of their children, concerning their calling and impliment of their children, especiallity of their ability to read and understand the principles of religion and the capital lawes of the country, . . . and they shall have power (with consent of any Court or magistrates) to put fourth apprentice the children of such as they shall find not to bee able and fit to imply and bring them up, nor shall take course to dispose of them themselves; and they are to take care that such as are set to keep cattle bee set to some other impliment withall, as spinning up on the rock, kniting, weveing tape, etc., . . . and for their better performance of this trust committed to them, they may divide the towne amongst them, appointing to every of the said townsmen a certeine number of families to have speciall oversight of; they are also to provide that a sufficient quantity of materialls, as hempe, flaxe, etc., may bee raised in their severall townes, and tooles and implements provided for working out the same; and for their assistance in this so needfull and beneficiall impliment, if they meet with any difficulty or opposition which they cannot well master by their owne power, they may have recourse to some of the magistrates, who shall take such course for their help and incuragment as the occasion shall require, according to iustice.*

And the influence of this belief may be traced through subsequent legislation down to the present day. How fully the domestic life, manners and customs of New England people exemplify the excellence of this doctrine of "learning and labor" in the education of children needs not here to be told. The story may be read on every page of New England history.

Thus do we see that the plain common-sense of the people has followed in practice the doctrine of the philosophers, that education by and through work — outwardly productive and useful work of the hands — is essential to the right intellectual and moral training of children, essential to the right training for citizenship in a free State.

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* "Records of Massachusetts," volume II., pages 8 and 9, printed, Boston, 1853.

Until within a generation the conditions of New England life were such as to permit full scope to this education by and through work. No better kindergarten was ever invented than the New England farm, provided only the conditions of life were not so desperately hard as to leave the mother no time to superintend the occupations of her children. For the growing boy there were the occupations of the field, the woods and the garden; and rainy days there were the tools in the tool room; or, if these failed to interest him, there was the neighbor's shop, where he might begin to learn his chosen trade. The wise father took good care that these means of education were properly used. All this answers precisely to the ideal circumstances pictured by Froebel in his "Education of Man." The home was to co-operate with the school in the education of the boy, taking more particular charge of the training of his active powers and of his religious life, while leaving the book studies to the school.

But railroads and factories have wrought a profound alteration in New England life. The conditions are all changed. People have gathered themselves into great and growing cities; the farms are deserted; of gardens there are few; and the neighbors who had workshops for their various crafts are now employed in great manufacturing establishments. Our population has become largely urbanized. The city father, however wise, however disposed to carry on the education of his boys "by and through work," finds insurmountable obstacles in his way. His own work is seldom such that he can share it with his boys; the "neighbor's shop" is hard to find; the "manufacturing establishment" takes no apprentices. He could perhaps provide tools and a tool room in his own house, were he at home enough to teach their use; but even then the boys would lack the time; for the public school claims their attendance forty weeks in the year, and can by law exact thirty up to the age of fourteen. So he is compelled, by the very circumstances of city life, to hand over the whole business of education to the schools. The schools must take care of the education "by and through work," or it will not be cared for at all. Meanwhile, the mother finds the ideal kindergarten of rural life replaced by the city sidewalk and the paved back yard.

Fortunate is she if she can get a small heap of clean sand for her little ones to play in. City children are like plants in a green-house or animals in cages, developing abnormally under abnormal conditions.

Thus has come to exist in all cities and large towns a profound educational want. All the people feel it; some see it and understand it; but heretofore little has been done to relieve it. The city school, with its forty weeks of term time, has merely filled with more book learning the gap left by the departed home employments. The traditional balance between "learning and labor" has been upset, and "learning" has taken the whole time. True, something has been done in one city or another towards providing substitutes for the lost home training. Sewing and cooking have become branches of school work for girls in a few places; and manual training in other forms is just now finding its place in the schools. These instances, however, are but slight exceptions to the general statement that until quite recently the schools have offered no substitute for that home training which children have lost in their change from country to city life. The schools have done nothing, because the way has not been clear; nor has there been, until lately, any strong desire to make it so. Meanwhile, the sense of something lost or wanting has been abiding and pervasive, although somewhat vague and inarticulate. Like certain conditions of the human body, it declares itself by symptoms. The ever-ready disposition to criticise the city schools for not turning out such young men and women as the country schools used to turn out, or as the schools of the same city used to turn out fifty or sixty years ago, is but a symptom of the underlying uneasiness. The same is true of the fussy desire for "something practical" in education. The numerous fathers who know not what to do with their boys, and the increasing multitudes of boys growing up in the cities with little learning and less labor, do but aggravate these symptoms.

Now, it is because people see or think they see in manual training a means of repairing the loss and relieving the want by which they have felt so long oppressed that they have so heartily welcomed this new means of education. If people have neglected

awhile that excellent old doctrine of "learning and labor," and have experienced the ill consequences of such neglect, the return to sound practice will not be slow nor half way, but quick and complete. It seems as if the hearty popular approval with which manual training has been received in these recent years might be the harbinger of such a happy return.

PART II.

By LOUISA PARSONS HOPKINS.

Elementary Manual Training.

While manual and industrial training was entering the upper schools through the workshops and laboratories, the kindergarten had gradually introduced a similar motive at the beginning of school education. Froebel had announced his philosophy of the child's development, and formulated the kindergarten as a natural and logical method for the child's earliest instruction. Froebel had adopted Pestalozzi's system of object teaching, and consummated it with his own peculiar doctrine of "learning by doing." The "gifts" which he provided for the child's observational use were supplemented by what he called "occupations," intended to complete observation by tangible representation. Manual training, therefore, had been growing simultaneously from both extremes of the curriculum, and the present problem is in connecting and interrelating the work from both extremes.

The kindergarten was presented to the world by Froebel about fifty years ago. It was introduced into this country by Miss Elizabeth P. Peabody and Mrs. Horace Mann a little more than thirty years ago. It was planted in Boston by Mrs. Pauline Agassiz Shaw nearly twenty years ago, supported and fostered by her personal enterprise and resources, and her sixteen kindergartens with their equipments and trained teachers were given by her to the city of Boston in 1887.

Miss Susan Blow did a similar work for the city of St. Louis, and Miss Anna Hallowell for Philadelphia. The kindergarten is now the accepted beginning of school education in the educational centres of this country and Europe.

Kindergarten Manual Training.

The occupations of the kindergarten are arranged for the systematic development of the child's powers, based upon the child's

natural activities; they train the sense of touch to nice observation and the hand to careful and skilful manipulation for the tangible representation of all the ideas of the mind and the expression of all the emotions of the soul. In this training of the hand the various senses are also educated; the eye especially learns to see more exactly and completely, so as to obtain the knowledge requisite to truthful representation in hand-work. Accurate expression is the test of accurate knowledge. Accurate and complete perception is essential to tangible expression.

The kindergarten occupations are connected with what are called "the gifts;" the results of observation as developed by the gifts are recorded by actual representation in "the occupations." The occupations are also designed to lead up to the chief industries of life, as well as to the study of nature and the development of art. These occupations may therefore be regarded not only as the completion of observation but as the beginning of training for industry, science and art; and in this respect they give the three-fold activities of the child their natural development, and may be taken as a model for all subsequent courses of manual training.

In discussing the significance of the kindergarten gifts and occupations, we may say generally that the gifts are meant to aid the child in classifying his observations concerning the form or appearance of things, and to serve him in his efforts to gain knowledge of things. The occupations, on the other hand, are to serve him in his efforts to express his ideas of things, and to apply his knowledge to the realization of a definite purpose.

The kindergarten occupations as laid down by Froebel are: —

1. Building with blocks; card-board construction.
2. Making forms and designs with sticks, tablets or rings.
3. Folding and cutting paper into geometrical forms.
4. Weaving with paper or other material.
5. Sewing on perforated cards.
6. Drawing, as a language for expressing form ideas.
7. Modelling in clay and other plastic material.
8. Gardening.

These occupations may be scheduled according to their relations, as follows : —

A. Bodies or solids:
1. Block building.
2. Clay modelling.
3. Card-board construction.

B. Surfaces:
1. Paper folding, cutting and pasting.
2. Tablet laying.
3. Painting.

C. Lines:
1. Stick laying.
2. Weaving.
3. Embroidery.
4. Drawing.

D. Points:
1. Bead stringing.
2. Peas, shells, etc. (arrangement of).
3. Perforating.

With the study of solids the child is helped to apprehend the distinct individuality of things; the study of surface helps him to classify things on the basis of their shape; the study of lines leads him to counting, measuring and the apprehension of direction and proportion; the study of points leads him to understand position and relation.

The clay modelling enables the child to record his observation of the most delicate deviations from the typical shapes, and leads him to an appreciation of type forms. The block building and card-board work develop his constructive talents; the paper folding and cutting stimulate his inventive power, and prepare him to record with brush or crayon the products of memory or imagination, and, with the weaving, embroidery and drawing, develop his artistic tendency.

It is plain also that the proper use of the material of the occupations results in moral power, because it implants in the child habits of industry, clearness, accuracy and harmony, which in attitude and motive influence his whole development, and co-ordinate him with his fellows in social and benevolent organizations, so as to make him a factor for good in the community of

child life. In all these occupations the individuality and creative power of the child should have full scope. They may be connected with observation of nature and life or with the imagination and feeling, yet they should be conducted according to the legitimate growth of the child's powers, and, in the main, according to a prescribed sequence founded on the great laws of educational philosophy. The child should be led from the easy to the difficult, from the simple to the complex, from the known to the unknown, in all manual as well as mental training. The exercises must be for the child, not the child for the exercises or system. Whatever is given to the child to do should be adapted to his interest, to his stage of progress and to his relations with life; it should advance him in knowledge and skill, should minister to his manual dexterity and creative instinct, as well as to his desire to communicate to others what he has acquired, and become useful and helpful to all; in other words, it should involve the activities of the body, the mind and the soul in their natural relations and order of growth.

Building is one of the most natural and pleasurable occupations of a child; it leads him to constructive rather than to destructive work, to skill in handling, balancing and arranging parts, to mechanical contrivance, to unity of design, to an apprehension of proportion and symmetry; it teaches him unconsciously many of the laws of physics, gives play to his imagination and inventive faculties, and involves a study of material as well as of forces.

Laying of sticks, etc., leads to decorative design and the representation of geometric and natural forms; it cultivates a perception of planes and lines, or edges and faces, and may be utilized in the study of the geometric outlines of objects, so far as such study can be properly carried with the little child. It is also suggestive of the study of number and place.

Paper folding and cutting gives skill of fingers and accuracy of measurement, and, combined with color, allows opportunity for a study of color, form and proportion, which is essentially artistic in its tendency.

Weaving involves color, careful hand-work, a knowledge of one of the most fundamental and inclusive industries, with opportunity

for a study of material and the applications of the art to various material. It may also be combined with color and design, so as to make the industry artistic, and educate the sense of harmony and proportion.

Sewing cultivates precision of the eye and hand, as well as the sense of regularity and measurement. It should, in the kindergarten, involve color and form, and be used as a kind of drawing and method of decorative design. It develops the moral nature, by training to habits of neatness, order, economy and helpfulness, as well as by appealing to the sense of beauty.

Drawing and modelling should go hand in hand throughout all the manual training of the kindergarten. In the study of nature and of the type forms presented by nature and illustrated by "the gifts" of Froebel, the drawing should be entirely with the free hand, and should be used chiefly as a means of thought expression by the child. Drawing and modelling not only train to manual dexterity, they also offer the readiest and freest means through which the creative feeling of the child can find expression; they are capable of constant application to every branch of study; they are connected with all industries; they develop the æsthetic sense and powers, and are suited to every grade of school work and every stage of education. In the kindergarten modelling the free fingers only should be used, and in drawing the pencil and brush should be used by the free hand only, other tools being postponed to the primary school.

Gardening leads the child to a love of plant life and to companionship with nature, as well as to healthful out-of-door occupation. Every kindergarten should have a garden-plot; but where this is impracticable, gardening may be carried on in the school-room by means of window-gardening or a sand box. It is one of the most delightful kinds of work to the child, and exercises in full sympathy and harmony all parts of his three-fold nature. It should never be neglected in the kindergarten. It may involve careful observation of processes, as well as forms; the hand-work of pressing, mounting, drawing and coloring of plant forms; the original study of plants in their conditions, their habits, their parts, their organism, their beauties, their processes,

laws of growth, relations with nature and life, as well as their expression of constant creative activity in nature; they lead to a recognition of the fatherhood of the Creator, and the sustaining love and power above and within the material universe for each individual life, thus developing in the highest direction the child's growing powers.

Although it may not be necessary to vary such a course of occupations as Froebel has laid down for the kindergarten, nevertheless there should not be an unyielding adherence to it under all conditions and circumstances. The purpose is higher than the means, and whatever is natural and educative must be regarded as legitimate in the training of the child before the primary-school age. Sympathy and original appreciation of the philosophy of the child's growth must determine the plan to some extent for every kindergartner. The child should be prepared by the kindergartner for more distinct lines of study and more concentrated application of the will and purpose to achieve in all branches of mental and manual training. The kindergarten must reach upward toward the primary-school subjects and method of study, and the primary school should vitalize its work by the adoption, to a great extent, of kindergarten methods. The doctrine of "learning by doing" should be applied to every line of study, and thus the kindergarten and primary work be an unbroken series of progressions. The kindergarten, as in most American schools, should be held in a room by itself, but in a building with the primary school, so that it may become familiar as a preparation for that grade. In the Board Schools of London and Liverpool, which were visited in the interests of this Commission, the kindergarten was so interwoven with the infant school that it was hard to see where one ended and the other began. The manual training of the English kindergartens is rather industrial in motive and mechanical in method, with a tendency to commercial values. Much of the weaving is with straw or twine, and without color. In the Paris kindergartens there was discerned a more artistic foundation and tendency. Objects of use are more generally ornamented, materials are of a kind to admit of more artistic rendering, — as, for example,

weaving with worsted is more common than with paper, as the fabric can be more easily ornamented, and the results enter more readily into harmonious combination and design, — also, the color tones are finer and more perfectly blended. In the kindergartens connected with the New Britain and Willimantic normal schools of Connecticut the children six years old apply kindergarten manual training to the study of plant life and of standard literature. Children of seven use sloyd and work with tools at the bench. Children's drawings, illustrating the development of the bean and pea from observation of specimens they had planted, are produced. Also object drawing, in color, of various plant forms, and illustrations of a study of Longfellow's "Hiawatha," is made the beginning of study in literature. In many kindergartens the history of the country is begun by making pictures or models of historical objects or personages, and acting out the story which they represent.

Manual Training in the Primary School.

Until within the past two or three years no course of manual training was devised for children in the primary grades. The field still remains open and comparatively untried between the kindergarten and the departments of sewing, cookery and wood-working in the grammar schools. The work of formulating appropriate lines of manual training for this intervening period has been and is largely experimental and in most cases fragmentary. While there are many courses for specific branches of manual training, there are but few which attempt to integrate the various occupations into a sequential course of exercises. In some courses which have been thus far developed, the industrial and utilitarian element has been a prominent feature.

Enough has been done, however, to indicate that the development of the kindergarten occupations furnishes the best basis for the manual training of the primary and lower grammar schools. In the large cities of this country and Europe this motive has given shape to all courses, and the kindergarten occupations are carried up in close connection with every department of study, so that the manual training becomes a method of work as well as a plan of work.

Opinions of Educators as to Primary Methods of Manual Training.

This course of development is in accordance with the doctrine of those most prominently associated with the manual training movement from the first. In an address before the Social Science Association, in 1884, General Walker says: "It is not so much the creation and endowment of separate schools of this character which is in view, as the gradual conversion of all the existing schools of the land to this use through the grafting of certain studies and exercises upon the traditional curriculum. As to the precise nature and extent of the studies and exercises which should to this end be incorporated in the public school curriculum, and as to the order of these exercises, much difference of opinion will doubtless be developed among those who advocate an extensive modification of the present system. The true system will of course have to be worked out through long discussion and experimentation."

In 1880 Prof. Felix Adler started the Workingman's School, in New York City, which introduced practical lines of industrial training and tool work for children. Professor Adler says: "Among those who have given most thoughtful attention to the subject, the following points are accepted, namely: that manual training means the training of the intellect as well as the hand; that its chief recommendation is that it offers a new instrumentality for training the mind; that manual training logically connects with the system of teaching at the point called object teaching; that the business of manual training is to deepen the methods of object teaching. The old object method was to teach the child to observe, but manual training teaches not only to observe but to create. The principal departments of school in which this method is illustrated are the departments of drawing, of geometry and of science."

"Manual training, in order to be fully educative," says Dr. W. N. Hailmann, "should at every step be in full touch with all the kinds of knowledge the child is seeking, and with the ideas he wishes to express. It must be connected with his number studies,

his form studies, his interest in physical and chemical properties, in motion and machinery, his nature studies, his geography and history, his language and art."

Mr. George Ricks, school inspector of London, says: "The manual training we contemplate is a form of education intended to develop general manual dexterity rather than special aptitude. Manual training must take its place in the general cultivation of the faculties."

These quotations indicate the determining motive of manual training courses above the kindergarten, and express the general aim of such courses as have been initiated in the primary and grammar schools. It is understood to be a method rather than a department of educational work, and the kindergarten occupations are accepted as the basis of the primary courses to be adapted to the studies leading to the higher courses. The study of language, number, form, place, color, mineral, plant and animal life are all developed by tangible means, and learning is accomplished by doing. Every idea is aroused by material presentation, and completed by actual representation. The self-activity of the child is engaged from first to last for the development of his powers.

Kindergarten Occupations in the Primary School.

The kindergarten occupations can be directly applied to the language and number work of the primary school, as well as to the observational study of natural forms. The material symbols of the manual training naturally introduce pictorial symbols, and these latter the conventional symbols of reading, writing and ciphering. Speech becomes a spontaneous expression of ideas generated by manual training, and operations in numbers naturally arise in connection with many of the kindergarten occupations. In considering feasible schemes of manual training for the primary school, we would suggest that the child be kept at work as much as possible on material which offers little resistance, such as clay, wax, paper and worsted. These offer a wide scope for progressive work, enabling the child to put the stress of his attention not so much upon the means as upon the end of his work, viz., the agreement of his results with his ideas. They can be readily

made to reproduce, with a high degree of accuracy, his observations or imaginations. They also furnish excellent opportunities for social work; tiles of clay or mosaic work in paper and design, patterns of embroidery in parts, will supply groups of children or entire classes with tasks referring to a common plan or purpose. Woven worsted squares combined in a general design arouse the interest and cultivate the benevolent activities better than many isolated efforts. This work may be made to lead to the threshold of art, and prepare the children for full efficiency in all relations of practical life.

Paper and card-board work in folding, cutting, pasting and construction affords means for adding to the gains from the handling of plastic material; habits of foresight and accuracy, which are invaluable in every vocation, are induced by these occupations, because the slightest errors are followed by irretrievable failure, while conscientious and careful work ensures success. Card-board modelling admits of closer attention to details than sloyd, and is therefore less crude and utilitarian. Paper cutting and card-board modelling are a sure foundation for scientific artisanship, which rests primarily on accuracy and adaptation of means to end. They also lend themselves to ornamentation through drawing, painting, inlaying, cutting and carving. Paper and card-board cutting can be carried through the first eight years of school life as a means of illustration in geometry and geography, mineralogy and botany, as well as artistic representation, in all of which it secures inventive and constructive skill, with manual dexterity and delicacy. Work which is done by the fingers is more educative to the brain than that which is done by broader areas of muscular activity; delicate work of concentrated nervous power serves a higher psychological end than crude physical effort. As the courses advance they should become more closely associated and inter-related, as well as more distinctive and elective in each line, so as to give freedom of development for individual gifts and aptitudes. Building with blocks may lead to discovery of laws of physics, as well as architectural design; weaving may become artistic, as well as more variously and usefully industrial; sewing may connect itself with art on the side of embroidery and dress-

making; clay modelling works for art culture, and especially for sculpture; coloring appeals most effectually to the æsthetic and spiritual nature; drawing as a means of expression and a common language of form seems to cover every part of the educational field equally with spoken and written language; gardening is appropriate to every period of school life, as a healthful out-of-door occupation, furnishing the environment of nature, and leading to a study of natural science and field work in mineralogy and botany. Every school should have a garden for the children to work in.

All these methods of manual training may be applied from the beginning to the end of school life, and to every study, constituting laboratory work in every line. All manual training should grow into applied science or art, and vitalize every branch of study.

Courses of Manual Training for Elementary Schools.

There have been various experiments and attempts to formulate a system of manual training between the kindergarten and wood-working shops. At the Conference on Manual Training, held in Boston in April, 1891, many of these schemes were represented, some of which are given in this report. (See Appendix M.)

In visiting the schools of some of the principal cities of the United States, we found the kindergarten occupations incorporated in the curriculum as a method of work applied to every branch and grade of instruction, notably in Washington, Brookline and Boston, where, as in some western cities, it is carried on by a course in stick and tablet laying, paper cutting and folding, sewing, clay modelling, drawing, painting and card-board construction. In a manual training exhibit of the schools of London, visited in the interests of this Commission, there was a great variety of work in all the lines mentioned. The drawing was fine in all departments, and designs in color conventionalized from plant forms were excellent. This work is under the direction of an art superintendent, with four specialists as assistants, who conduct the work of their departments from the kindergarten to the training school. There is a noticeably scien-

tific bearing throughout the manual training of the Liverpool and London schools. Mr. George Ricks, inspector of the London Board Schools, claims to have initiated and formulated the system of manual training for the consecutive course so as to relate it to every study and every grade. In the Liverpool Board Schools the courses are well permeated with manual training, and the Day Industrial Schools and Certified Industrial Schools give proficiency in the common industries and occupations of life. In the Board Schools much is made of mechanical and geometric drawing, and Mr. Hewitt, the director of science, has given a distinctively scientific value to the work. The making of simple apparatus for physical laboratory lessons, cabinets for natural science collections and working drawings for all tool work is a strong feature in the Liverpool course. In the Paris school work the art idea prevails, and beauty is invariably associated with use; color enters into every part of the work, and historic ornamentation is suggested in every grade of hand-work. It is a prominent fact in the courses of the European schools that the work is built up under the direction of eminent scientists and educators, and a training in art is considered necessary for the instructor in manual training and artisanship. The work of Liverpool, London and Paris was personally inspected as far as opportunity allowed. It is an accepted doctrine in these cities that the ends to be sought in manual training are preeminently educational. In Germany the work has been growing, and the schools of Leipzig, Dresden, Berlin, Heidelberg and other places carry on manual training for young children with great success. In Sweden and Norway sloyd fills the various grades.

There is still a good deal of experimentation along detached lines in all our cities. In Boston great freedom of selection is given to the schoolmasters, and the work is still tentative in the lower grammar grades. Sewing and cookery are required and well systematized for girls; but a variety of courses of other manual training is exhibited in the schools, according to the inclination or opportunity of the master and the conditions of the school. In some grammar classes knife work with flat wood in

geometric forms, or small models of useful articles, and wood-carving, are undertaken. In others the interest is devoted to color work and design with fresco paints; in others, notably the Italian districts, clay modelling and plaque relief forms are frequent; in one school quite remarkable work has been done in connection with nature study; in others black-board sketching has supplied the manual training and art work for the lower grammar grades. Geographical illustration in clay, the construction of models in wood or card-board to illustrate the principles of physics or machinery, drawing in color, with pressing and mounting of flowers for various lines of botanical study, arrangement of specimens in science, and so forth, have furnished the motive of manual training in many schools.

The Springfield schools have, for the lower grammar grades, a course in whittling at the ordinary desk and in the ordinary class-room. The Northampton course is a logical sequence in wood-working with the knife, through every grade; it is artistic as well as scientific in tendency.

The Connecticut model schools introduce sloyd for children from ten to fourteen years old, using the saw, file, plane and chisel. The Eva Rodhe models, endorsed by the Nääs school, are for children from five to ten, with tools adapted to their use. The object made, rather than the exercise or tools mastered, has been emphasized in these sloyd courses, in order to secure the child's interest, and strengthen the moral motive.

Some primary-school courses include kitchen gardening and elementary housewifery. The Landreth School, of Philadelphia, trains the younger girls to set and clear a lunch table, wash dishes and keep a room in order, decorate the teacher's desk and wait upon visitors, as well as attend to the detail of daily school-room service. This kind of instruction is a part of the kindergarten idea of social education.

A number of published courses of manual training foı primary and lower grammar grades, or advanced kindergarten occupations, have been given to the public. "Primary Methods," by Dr. W. N. Hailmann, shows how the occupations of the kindergarten can be applied to language, number, nature study, geography and

so forth. Miss Marwedel's "Missing Link" carries the kindergarten occupations forward with study of form and color, woodwork in grotesque forms simulating movements of life, nature study, etc. Mr. George Ricks of London has set forth a course, in his "Hand and Eye Training," which makes much of block building as a means of mechanical and architectural training, connected with drawings of plans and elevations, object drawing for perspective with design and historic ornamentation, — a complete course. The same book emphasizes the elements of color and conventional design and card-board work as adapted to grammar-school grades.

Professor Hewitt of Liverpool has published a treatise on manual training for intermediate grades. In this book we have an admirable series of carefully arranged exercises on paper cutting and folding, modelling in clay, drawing, lath bending, etc., which cannot fail to interest and amuse the dullest pupil. The exercises, too, are so carefully selected that the instruction imparts a good foundation knowledge of the truths of geometry.

The study and use of color is a most important educational element in manual training. It should begin with the kindergarten and extend through every grade. The training of the sight, together with the color sense, should be simultaneous with the training of the hand in applying color. The study of the standard colors of the spectrum should be introduced into the kindergarten occupations of weaving, of sewing and of paper cutting and design; tints and shades of color, secondary and tertiary colors, should be made further subjects of study in the primary school, and the application of the spectrum to design and representative drawing should carry with it a growing appreciation of harmony and delicacy of color. The use of colored crayons in free-hand drawing, or the use of the brush in the application of pigments, involves most careful training of the color perception and of the hand. The appreciation of color and the harmonious rendering of the coloring of nature in free-hand drawings with the brush from the direct study of natural forms educates the æsthetic sense, and leads to the highest interpretation and correlation of science and art. In the use of the brush great care is necessary; putting

washes of color on to definite outlines of form involves most exact manipulation, and gives a very close training of the hand. A course of work in color, by S. W. Tilton of Boston, presents a well-graded and related system of the use of the brush, and carries with its progressive lessons the thorough training of the eye and hand, the careful and sympathetic observation of natural and artistic forms, and the cultivation of the sense of beauty and harmony, which is in the highest degree developing to the spiritual nature. The element of color is strongly developed in our best courses of hand and eye training, both in this country and in Europe, and is recognized as essential to the true study of form and the best results in manual training in school education.

No arbitrary forms or symbols should be imposed upon the child for manual representation. He should observe natural forms until he apprehends their typical character. The sphere should be shown in the bubble, the drop, the leaf cell, before its artificial representation is forced upon his attention. He can mould it in the hollow of his palm before he attempts to copy it as a model. The cube and other symmetrical forms should be presented to him by the mineral or the plant form, and then by its production by pressure from the sphere. The cylinder should appeal to him in the form of nature before being put into his hands as a type form. The tree trunk, the grass stem, will reveal it to him as a prolonged cell and a common form of plant life. The egg is nature's perfect ovoid. The stalactite, the sand heap in the hour glass, are phototypes of the pyramid, and show the process of formation as well as the arrangement of parts. In fact, we should begin with the discovery of the phototypes in nature, rather than with the type models of art. The discovery of the action of natural forces which produce typical forms, such as the rotation of a straight line in a given plane about a fixed point to produce the circle, the rotation of a semi-circle about an axis to produce the sphere, the rotation of a rectangular plane about an axis to produce a cylinder, the rotation of a triangle about an axis to produce a cone, the equal and opposite pressure upon a sphere to produce a cube, the same upon a cone to produce a pyramid, etc., may lead the child

to recognize the typical character of these forms before he is presented with their artificial models. The child should begin with nature in his approach to art, and not with conventional patterns which are thrust upon him.

In the choice of occupations as means of manual training, some regard should be paid to the natural and available industries of the place or the people where the child is, that his interest may be more real, and that the idea of helpfulness may be emphasized. Some of the old New England industries may, perhaps, be substituted for those already in the curriculum, yet never for the mere accident of custom if not as good educationally. Plaiting with straw for baskets or bonnets, braiding strips of cloth for rugs, knitting, crocheting, working rugs on canvas with a hook and bits of cloth in various colors and patterns, are all traditional household industries of New England, and give excellent training for the hand and eye, as well as for the social instinct. Mosaic work in tiles would be very pleasant and educative occupation in the schools, and might be made decorative to the school-room.

In the various occupations laid down by Froebel, a logical sequence of development is inculcated. The sewing, the block building, the paper folding are to be carried forward by a definite series of steps and unfolding of design, which cultivates the logical sense unconsciously, and leads the child to a perception of sequence and prepares him for inductive reasoning. This idea of development should be continued throughout the manual training of the schools. It is made the chief factor in the sloyd work, and dominates every other purpose.

After the adoption of the kindergarten into the Boston school system it became evident that manual training must be carried up into the primary grades. A course of exercises was personally initiated in 1888 by the present writer, and in 1889 it was formulated by her, in outline, for the "Boston Course of Study." It was ordered in all the primary schools in 1890, and the course elaborated in detail by Mrs. Caroline F. Cutler. This detailed course was connected with that of drawing already in the schools, and was published as a manual which is now in use in the Boston schools. The Boston primary manual training course has been

adopted literally by various cities all over the country. This course, with others, is given in Appendix M. Photographs of Mrs. Cutler's course are also given. (See Appendix N.)

The "Prang Course" in form study offers a series of exercises which have in them very largely the element of manual training, and which are easily affiliated with much broader manual-training exercises, as well as developed in any one direction, according to the conditions of the school or aptitude of the pupil. This series puts distinct emphasis on the development of the child through his æsthetic feelings, and creative activities as expressing those feelings. The industrial idea is not lost sight of, but in the early stages of the work is of the least prominence, and subordinated to ideas of beauty. As the "Prang Course" is the only course thoroughly presented by charts from kindergarten to high school, it is shown in Appendix N by photographs, with an explanation of its motive, quoted from the "Kindergarten Magazine," and written by Mrs. Mary D. Hicks, director of the Prang normal art classes.

Conditions for Manual Training.

The relation of manual training to every department of education should be close and continuous. In respect to physical training, of which it is a part, the offices should be mutually helpful. Exercises of the whole body, with reference to the harmonious activity of all parts; corrective training of posture and movements, to balance any one-sided development incident to manual training; lung exercises in pure air before and after manual-training lessons; sitting and standing exercises, counteracting habitual postures of hand and arm in manual training; corrective exercises in looking at objects from a distance, after the short range of vision required by the use of hand tools, or of looking with both eyes or with one eye less used; hygienic practice in thorough cleanliness, giving flexibility and other right conditions for healthful physical training, — all these should accompany, or rather underlie, all manual training. The schools of England and Sweden present a lesson in this direction for American schools. The basin, wash-cloth, soap and towel for each individual pupil,

the bathing appointments — tubs, swimming-tanks, etc. — in every school, show a great advance in hygienic provision over our own accommodations ; the lighting of school-rooms arranged under the direction of oculists as well as architects, also the play-grounds and physical appliances and accommodations, give evidence of a care for the health of the child which we have not yet assumed. All these lines of development should proceed conjointly with manual training, in order to secure the best results.

In much of the work hitherto mentioned, manual training is recognized as a method rather than an end, and it is taking its place in our curriculums as a plan of development in every line of work. All the detail of subject or system is as yet an experiment; the plan most wisely educational is the best plan ; but that excellence must be determined in a large measure by the conditions of the school, the wants of the children and the aptness or opportunity of the teacher, as well as by the practical preparation which it provides for actual life.

In formulating courses of manual training, it seems especially important to recognize also the spiritual side of the child's nature, and give it opportunity for development by providing for the exercise of the æsthetic faculties as well as the moral activities, and furnishing the stimulus of beauty in all study of form and color and all directions of manual training. This would involve placing within the child's reach all that elevates the feelings and embodies the highest ideals. If possible, give to the humblest of our children the advantage of the supreme culture of the world in literature and art to guide them in the recognition of the best standards, and to point them to the masterpieces of the race. By so doing we give the child his right to freedom of growth under the best conditions through which his creative impulses will be ennobled and strengthened, while his hands are made skilful to express them for the moral and spiritual benefit as well as the intellectual and material progress of the community, as he grows into his relations with the life of the world. All these avenues to physical and spiritual culture must be kept open, in order to purify, enrich and elevate a course so tangibly embodied and so easily made materialistic and mechanical. Hygienic conditions

must be given to labor and an artistic tendency to industry through the methods of manual training in the schools. To this end access should be given to our public-school children to museums not only of mechanical inventions but of science and art.

Moral Result of Manual Training.

Occupation, although the passive side of manual training, is yet the salvation of disciplinary methods. Give the child a tool, you at once differentiate him from the animal; he begins to feel his human capacity and his human relations; he wants to work out his ideas and give tangible shape to his thought, to communicate what he knows, and become a unit in the unity of human brotherhood. Fraternal industry is the watch-word of our times. A few principles and simple tools give the key to all trades and arts. The boy must know how to take his place in the economy of the household. Give him the saw, the plane and the hammer. Let him take his knife out of his pocket, and turn it to good account. Let the girl learn housewifery, sewing and cooking, that the home may be a beneficent factor in our private and public life.

"The exercises in manual training," says the "Boston Course of Study," "are a means not only of physical and intellectual but of moral culture. They train to habits of accuracy, neatness, order and thoroughness; they exercise the judgment, will and conscience; they present an incentive to good work in all directions, and offer a moral stimulus and preparation for usefulness at home and in the community."

The children are taught to love tangible work, — and what child does not? They are trained to be apt in applying their constructive and originative powers to the material about them. They are related to the industries which develop all our resources; they are given mastery of all their active powers. They learn the elements of labor and service in which all share.

All our present efforts at industrial education are in the interest of homes that shall save men from vice, society from disorder and the laborer from despair. Skill at some trade, aptness at some hand-work, the ability to support one's self, to do something which has a market value, is a great preventive of crime. Who

can point to a skilled mechanic of good habits and available health whose family are beggars? Systematic labor, work for a purpose not merely mechanical but scientific in method, is the outcome of manual training in the schools.

Testimony of Boston teachers after the initiation of manual training in the lower schools: —

"The boys looked forward with great pleasure to the privilege of using the tools. Many times they would voluntarily remain after school to finish the articles they had begun."

"The beneficial effect of this work on the pupil is surprising; whereas, before it, there had been cases of truancy which were considered incorrigible, and corporal punishments were of daily necessity, after it not a case of truancy occurred, nor was corporal punishment once necessary."

Much testimony has come to hand in cases of children of deficient intellectual development whom the simple forms of manual training have been potent to arouse and stimulate. Such children have advanced in their power to learn by exercising their power to do.

Manual training and physical training offer a solution of the moral problem of school education. Orderly hand-work is regenerative when all directly ethical means are of no avail to build up character. Its material advantages are so plain that they need no recital; its educative power is what most concerns us in the consideration of our school courses.

Conclusions.

From these various considerations it becomes evident that manual training, in order to be effective as an educational method, must connect itself with all branches of study; that it must be well conditioned morally, physically and socially, and develop in three directions, — namely, industry, science and art. The industrial element must become fraternal, must connect the child with his fellows, and prepare him to be a worker and helper in the community of practical life; the scientific element must connect the child with nature, and prepare him for discovery and creative skill, that he may add to the resources of common life and minis-

ter to the common good; the artistic element should connect him with the ideal in all things, and lead him to spiritual culture and influence for the elevation of mankind. Thus the child is related throughout his school education to nature, to man and to God.

Taking the kindergarten occupations as a starting-point, we may follow them out in this three-fold development, by progressive exercises and more and more resisting material demanding more and more complex tools and ever-increasing skill and higher results, both educational and practical. The result of a course of training with tools is a mastery over one's powers as well as over the material handled. Self-respect is induced, which should never be carelessly overthrown by treating with indifference or rudeness anything which has been conscientiously made by the child, as such treatment destroys the interest and frustrates the moral purpose of the work. A few exercises with simple tools give the key to all trades. The psychological result is broad and distinct, and builds up mental strength and adaptability. The moral result is to awaken a feeling of conscience, power and self-control, to train the will to instant efficiency and the moral discrimination to keen and sure judgment.

Sewing.

The first branch of industrial education which found a place in the schools of Boston was sewing for girls. As early as 1835 the girls of the second and third classes of the grammar schools were instructed in sewing and knitting by their regular teachers, one hour a day. In 1854 a petition was presented to the school committee by a large number of Boston women, which resulted in the establishment of sewing for all fourth-class grammar-school girls, two hours a week, under the instruction of a special teacher for each school.

At the instigation of Mr. Robert Swan, master of the Winthrop School, in 1872, the sewing and other industrial education was made legal by an act of the General Court of Massachusetts, entitled "An Act to authorize cities and towns to establish industrial schools" (1872, chapter 86), and reading as follows: —

The city council of any city and any town may establish and maintain one or more industrial schools, and raise and appropriate the money necessary to render them efficient. Such schools shall be under the superintendence of the board of school committee of the city or town wherein they are established, and such board shall employ the teachers, prescribe the arts, trades and occupations to be taught in such schools, and shall have the general control and management thereof: *provided*, that in no case shall the expense of any such school exceed the appropriation specifically made therefor; and *provided*, that nothing in this act contained shall authorize the school committee of any city or town to compel any scholar to study any trade, art or occupation without the consent of the parent or guardian of such scholar, and that attendance upon any such school shall not take the place of the attendance upon public school required by the law.

By this act Massachusetts took the lead in public industrial education in this country.

In 1873, upon application of Mr. Swan, a teacher was appointed in that school for every class, teaching the highest classes to cut and fit their own dresses. In 1876, instruction in sewing, two hours a week, to the three lower classes in the grammar school, was established by the school committee. Since that year it has increased steadily in efficiency in all the schools.

The cost of material for all the schools is but a little over two hundred dollars a year; the salary of a teacher from five hundred to one thousand dollars, according to the number of hours she is employed. The cost of material in the Boston schools is less than one dollar per class for one year, and the average number of pieces made each year nearly two thousand per school.

To the Winthrop School, through the untiring energy and benevolence of its master, sustained by the charity and sympathy of the women of Boston, and especially of Mrs. Mary Hemenway, is due the honor of beginning and leading in this useful and honorable work. The evident need of some practical training for girls in domestic employment was its immediate inspiration. The purpose was not so much educational as utilitarian and industrial. The instruction has been individual, even with large classes, and the children have always been led to make useful household articles and garments, and to acquire skill in plain needlework.

Mr. Swan has spread the knowledge of this department all over the land by sending reports of its operation to school committees and superintendents, and by showing the work to visitors from all parts of the world. Almost every large city and town in the country has applied to Boston for information in regard to the establishment of this department of school instruction, and the Boston school sewing exhibits have won prizes at every large industrial and educational exposition for several years.

Sewing is now a part of the regular instruction in the kindergarten and primary schools, where it is carried on by the regular teachers, both for boys and girls. Classes for boys have, in some cases, been formed in the grammar schools for instruction in sewing, and have found aptness and enjoyment in the work.

Sewing, as a branch of domestic industry, is carried on in girls' schools in England and on the Continent. In England, Belgium and France the instruction extends to embroidery and artistic work. Advanced needlework is offered as part of the course of Drexel Institute, Philadelphia, of the Pratt Institute of Brooklyn and others in this country, also in the South Kensington School of Art Needlework, and many of the schools of Paris. Some account of such work is given in the records of the investigations of this Commission during the summer of 1892. (See Appendix M.) Some courses in this country have a more educational motive than others. The Brookline course is perhaps the most progressive.*

Cookery.

Instruction in cookery was first given to public-school children in this country under the auspices of the Young Women's Christian Association, in 1880. In 1883 the North Bennet Street Industrial School established instruction in cookery for classes from the public schools. In the summer of 1885 a vacation cookery school was established by Mrs. Hemenway. It was thoroughly equipped, and in the fall was offered for the use of Boston schools. The school committee accepted it under the name of "Boston School Kitchen, No. 1." Pupils were sent from several

* The Brookline and Boston courses have been recently fully presented in illustrated text-books published in Boston.

schools, at the rate of one hundred a week. This school was supported by Mrs. Hemenway for three years, until its industrial and educational advantages were fully demonstrated, and in 1888 the city assumed the charge of the school, having established similar schools in South Boston and Roxbury, followed later by others in Charlestown, Allston and East Boston. Cookery is now a regular branch of instruction for all girls in the second and third classes of the Boston schools. In some cases boys are members of the cookery classes. Mrs. Hemenway has also established a normal school of cookery, from which competent teachers are supplied. The examinations for cookery teacher's certificate, like those for sewing teacher's certificate, require an equivalent of the grammar-school course of study, with special examination in domestic and household economy, principles and processes of cookery, and chemistry and physiology as applied to cooking.

Instruction in cookery has been established in England for some years. The Northern Union of schools of cookery, established in 1876, includes many training schools which have supplied teachers for all the world, and set the standards of courses in cookery and housewifery. Cooking now holds a high position in the educational code of Europe. Glasgow, Liverpool and South Kensington have qualified more teachers than any other schools. The requirements of these schools have been largely adopted by the cookery courses of our own cities.

Belgium and France have been prominent in establishing this department in the public schools. Laundry work is usually connected with cookery in the curriculum of European schools and some American schools, but here it does not prevail. In this country a few Eastern colleges for women, many Western agricultural colleges, the Drexel Institute of Philadelphia and the Pratt Institute of Brooklyn, give courses in domestic science and arts. In our own State no one has done more to awaken an interest in the educational value of domestic science and to initiate its courses in advanced institutions for women than Mrs. Ellen H. Richards, instructor in the Massachusetts Institute of Technology. Her monograph entitled "Domestic Economy in Public Education," published in 1889 by the New York College for the Training

of Teachers, is the most noteworthy contribution to the subject, and is presented in Appendix N. The Drexel and Pratt institute courses of domestic science are given as models. A lecture course on house decoration is also presented as a suggestive plan of work in such a department. (See Appendix M.)

An estimate of equipment and cost of a school kitchen, and of the running cost per pupil of the sewing and cooking as well as the kindergarten departments of manual training, is presented in Appendix N.

In England and in this country the department is provided for in the public schools by cooking centres or school kitchens, which receive classes from groups of schools, with a permanent teacher for each centre.

Vacation Industrial Schools.

Immediately after the organization of this Commission, the writer spent some days in visiting vacation industrial schools of Boston, — the North Bennet Street School, the Tennyson Street School, the King Street School in Roxbury, the Warrenton Street School and the Waite School being the most important within the city limits. These are each supported by some private, charitable organization, and under the supervision of managers appointed by these organizations. Kindergartens and sand gardens are well conducted and largely attended in all. Clay modelling, drawing, sloyd, carpentry, printing, chair-seat weaving, shoemaking, sewing, cooking, kitchen gardens, dress cutting and fitting and a few minor industries are carried on in one or more of the schools. The schools are always full and many of the manual training classes crowded, although the attendance is irregular. It is evident that children who would otherwise be in the streets all summer are here occupied happily and profitably, and the schoolrooms, otherwise non-productive for weeks, are utilized for the good of the community. It is difficult to get the boys out of the carpentry classes at the hour for closing, as they take such interest in the work. The little girls, learning how to keep house, to set the table, to wash the dishes, wash the clothes, make the fire, sweep, dust, etc., are all engrossed in busy play; while the sewing

and cooking, the printing and shoemaking are followed with eager interest by the older children. On the whole, we are convinced that in this direction a most valuable field of operation for manual and industrial training and practical use of our otherwise useless school buildings during the long summer vacation invites the attention of the State, for the benefit of thousands of children who are literally vagrants in our streets during that time, and perhaps making rapid strides in criminal habits, incident to protracted idleness while the statutes forbid their employment as wage earners.

The first vacation school in Boston was opened by Miss M. E. Very, a teacher in the Hillside Grammar School. This was carried on unaided for a few years at the North End. In 1881 a kitchen garden was introduced, through the kindness of Mrs. Hemenway. The school committee allowed the use of school-rooms, and the number of schools increased within another year to five. As to the manner of conducting the school, Miss Very wrote: —

> I do not ask the children to commit anything to memory during July and August. I allow them to whisper and move about gently. I find it very difficult to make a child go home before the school closes. That is my only punishment. My only rules are that they must come clean, and not use profane language or quarrel. We sing the first and last half hour of every day. We have kitchen-garden work, sewing, drawing, reading, moulding with clay, assorting of squares of colored paper, playing with dissected pictures and other kindergarten occupations.

This is the first recorded manual and industrial vacation school for little children in Massachusetts.

Permanent Industrial Schools.

Many industrial schools supported by private enterprise have been established both in this country and Europe. The North Bennet Street and Warrenton Street schools have been for many years not only broad practical charities in Boston, but nurseries of manual training. In Liverpool the Day Industrial and the Certified Industrial schools, which are described in Appendix N, present some interesting features for considera-

tion in this country. The Maternal Schools of Paris, also described in the account of personal investigations for this Commission, teach several practical industries for girls. (See Appendix N.) The Workingmen's School in New York, conducted by Dr. Felix Adler, is one of the oldest of these schools in this country.

For the Industrial Schools of London and Liverpool, see records of visits in the interest of this Commission, also reports of Day and Certified Industrial schools of Liverpool, in Appendix N.

Normal Industrial Schools.

The Nääs School of Sloyd in Sweden, the University College of Liverpool, the New York Training College for Teachers, the Pratt Institute of Brooklyn and the Boston Normal Cooking School are among the most prominent institutions for normal instruction in various branches of manual training. Technical courses in kindergarten, domestic science and arts, and in various branches of manual training, introduced into the public schools, should be a part of our normal school curriculum. It is of the greatest importance that the teachers should be thoroughly trained on special lines, in order that these new departments and methods of education shall be well founded and conducted in our public schools.

Domestic science and arts should be made an elective course in our high schools and colleges for girls, or special schools should be established for such courses. We cannot present the subject better than by giving the curriculum of such courses as have been already established, and referring to Mrs. Richards' monograph, given in Appendix N.

PART III.

By GEORGE E. McNEILL.

Social and Economic Aspects.

Civilized and enlightened government is possible only where the citizens are free and enlightened,—free materially as well as politically, and enlightened morally as well as intellectually. These conditions cannot exist where the great masses of mankind are dependent upon a comparatively small class of their fellow citizens for the opportunity to labor, or the means to acquire knowledge and property. Free government means free training, and enlightened government means enlightened training.

The men who landed on the shores of Plymouth were divinely trained and led in matters spiritual and fraternal, and were as devoutly led in matters industrial and political. The Bible and the musket rang out their challenge to the world.

The meeting-house was the centre of the democratic union of Church and State, a union of faith and works. It was a religion without a bishop and a State without a king. The colonists had great reverence for learning and no less respect for labor.

The "Puritan," sneered at by the dilletante liberalists of to-day, was a hard man,—hard to contend with, whether in the field of productive labor or destructive war, in religious argument or political debate. He was the best equipped man of his time. As populations increased and industries became more diversified, his adaptability was extended.

Every home had its Bible, its library, musket and tool chest. Householders were landholders. Children were nurtured in the fear of the Lord, in habits of industry and frugality and a knowledge of letters. They were trained in the use of the musket and the tools of industry. They of necessity kept their houses in repair. The boys in such homes not only learned the art of sawing and splitting wood, but of sharpening the ax on the grindstone and the saw teeth with a file.

The school-house was an important part of the democratic unity. Upon the foundation of religion, industry and learning rest our free institutions. From a race of men so trained sprang the men and women who wrested peace and prosperity from the control of opposing nature and wild men. From the meeting-house, the school-house, the fields and the ocean graduated the men and women of 1776, the authors of our political independence, the founders of our States and the creators of the Union. For over two hundred years men thus trained and cultured held New England safe from external and internal danger. Work, worship and study were the order of daily life and the means of grace through which to attain heaven. Prayer welcomed the day of work as well as the day of rest. Ignorance and idleness were considered the worst of carnal vices. Ben Franklin's proverbs were but the pithy presentation of a secular catechism long before in practice.

A boy of twelve years of age who could not use the tools required for the manual training school of to-day was held to be below par. It would have been said of him that he had no "gumption." Boys and girls were the home helpers. They were trained in household duties from their earliest years. Boys, as well as girls, could sew and knit, and many of the boys could cook. They braided carpets and mats for home use and adornment. Children's clothing was made in the home for the children of the home, and, although such clothing was not as stylish as the garments of to-day, it was free from the danger and misery of to-day's product of the sweater's den and tenement-house.

In the memory of many men now living, the common-school education in the use of words was supplemented by the family education in the use of tools and implements, school and family uniting in quickening the moral perceptions of right and wrong. The result of this joint cultivation of heart, head and hand is found in the great names of our country's history, and in the advanced moral, intellectual and material condition of our people. As a rule, our great men have been educated men, not learned men, — educated in the school, on the farm and in the workshop, — educated in dealing with men and things, as well as in

fundamental principles. To the common people, graduates of the family, school and workshop, are we indebted for the civilization we enjoy.

The congregation of populations around the factories and workshops in large towns and cities, and the increased demand for unskilled laborers in commercial and transportation centres, deprived the children of the workers of the joint educational influences of home and school.

The carpenter, blacksmith and shoe shops of the neighbors were always open to the observation and often to the use of the boys, wherein they learned something of the use of wood, iron and leather, and the processes of their manufacture.

In the crisis of the Union, men were found in the ranks of the New England volunteers who could do any kind and all kinds of work, and do it well, not only because many of the men were skilled in special trade, but because a Yankee-trained boy is full of the genius of invention and marvellous adaptability and power of execution. A pocket jack-knife was a part of every boy's outfit. Sloyd was and is practised by all country boys. They made boxes, toy boats, boot-jacks, traps, sleds and carts, and an infinite variety of toys and household things. They commenced modelling in clay at kindergarten age, beginning at mud pies and working up to marbles and even to dishes for play. Drawing may not have been taught, but it has always been practised. Paper hanging, whitewashing and painting were often a part of the work of the family. Many families reserved a place in the barn or wood shed for a bench and tools, and many hours of manual training were profitably employed and enjoyed in these "barn chambers" or work laboratories.

From the home and the school the boy graduated, to enter either the workshop or the college.

The mechanic, at the completion of his apprenticeship, was master of his trade, self-respecting and respected. He made a whole thing, thus developing the different faculties of the mind and body, the diversity of his employment giving zest and rest to his labor. He was measurably self-dependent, and therefore independent. With good health, a good trade, a good character

and a public-school education, he was the peer of any man, a citizen sovereign in whose hands free institutions were safe.

The manual training school is a necessary substitute for part of that which has been lost to the children of to-day.

Under the old system, the shoemaker made shoes, the carpenter built houses. Now a shoe operative repeats one process upon one given part of the shoe, and it takes about one hundred shoe operatives to make one shoe. The carpenter may be a floor layer, a door and sash maker or a finisher, but rarely will he be a carpenter and joiner.

The wage worker of to-day, whether a hand tool or a steam or electric tool worker, is less and less required to depend upon himself in his work; his opportunities of development in his work are limited, as compared to those of former times.

The monotony of the present process of production leads to demoralizing excesses in many directions that would become more disastrous to the whole community but for the opportunities of the trades unions and reductions in the hours of labor.

The old system of apprenticeship and the old system of employment have passed away forever. The present system of production and distribution is but short-lived. The paramount question of to-day is, not how shall wealth be more rapidly produced, but how shall the qualities of manhood, womanhood and childhood be improved. This the manual training system seeks to do in part.

That the production of wealth is essential to the development of the best in humanity is evidenced by the history of the human family; but it is equally true that wealth is most rapidly produced where it is best distributed, and that wealth is best distributed where manhood and womanhood are best developed.

The Chinese know how to write and read, they are able to keep accounts and generally conform to the laws of their community; yet poverty is almost a universal condition. They have skill and adaptability in the most marked degree, their mountains are full of coal and iron, vegetables and grain abound in great varieties, yet these millions of an ancient race are lowest in the level of civilization of any nationally organized people.

Confucius said that "those who work should first be esteemed and rewarded by the measure of their salary." The departure of the Chinese from this principle, enunciated by their greatest philosopher, and the method and scope of their educational system, has led to poverty. Or, as Dr. Harris says: "Mere prescription, mere inhibitory will-power, developed to extremes, produces only a mechanical civilization, — a dead mechanical state of social existence." We look upon the Chinese education as productive of such a condition. All is cut and dried and given to the pupil as a ready-made form, into which he must fit himself by inhibition of natural caprice and inclination. The consequence is the least possible progress and the completest administration of the old system.

The dignity of the citizen and not the dignity of his product is the thing to be taught. If we take care to develop humanity, all producing processes will take care of themselves. The inventive power, the likeness of God in man, is possible only when the human soul perceives an idea and works out its application to a given purpose. Inventions are profitable only when the aspirations and wants of a large number of persons have lifted their earnings to the higher level of civilization.

Handicraft, as a means by which the masses of mankind can earn a living, is being replaced by machine-craft. Machine-craft in the production of a given article may be, and sometimes is, a barrier to ability in operating other improved machinery. Machinery is displacing and discharging laborers faster than new employments are provided. The steam shovel and other appliances are reaching the poorest-paid and hardest-worked and most illiterate so-called unskilled workers.

A reaction from present methods to something akin to the old handicraft system is as possible as the increase of illiteracy and the reduction of wages. Handicraft will increase in new directions artward as the hours of wage labor are reduced and the hours of leisure increased.

Learning a trade is like learning a dead language, useful as an accomplishment, but useless as an investment, save as it interprets a past mystery and disciplines the learner.

The lack of skill of wage earners is largely caused by the fact that skill has no permanent value, no dignity, no appreciable approbation. The skill acquired after years of work may be rendered useless as a means of earning a living by the introduction of machinery. The mind and the muscles of the workman have been trained in one given direction, and this training renders him less fit for the operation of the machine, and indeed for any other occupation.

The plain men, labor reformers, who studied the industrial conditions and the evolutionary processes of development, foresaw that adaptability and availability were worth more than skilled ability. They were among the first to advocate and demand the kindergarten and the school of technology. They wrote, lectured and petitioned that the school should be the place of resistance to the demoralizing influences of the rapidly decaying industrial and social system, and a source of persistence in the direction of the moralizing influences of enlightened civilization.

That some workingmen should oppose the extension of school work to primary preparation for manual pursuits was to be expected. Men whose occupations are their life must needs be jealous of everything that tends to increase competition. They know by instinct, if not by experience, that wages, under the pressure of competition with other laborers in the same craft, will, like water, seek its lowest outlet; and they feel that resistance to lower wages, like resistance to tyranny, is obedience to God. The training of the mind to comprehend the draft of a thing and the training of the hand to produce it, when directed in any one craft, would necessarily increase competition in that occupation, and at first the school-taught mechanic would feel a degree of superiority over the hap-hazard mechanic of to-day. The employer, in turn, would give preference in opportunity to the former, but would only maintain that preference if the former was cheaper to him than the latter. Under the present industrial system, cheap labor is preferred to high-priced skilled labor, and constant effort is being made to reduce the number of the skilled. As a rule, the best paid skill is that of overseership, that is, the ability to increase production to the maximum and to reduce the

cost of production to the minimum. The first requirement in productive enterprise is rapidity of production, not quality of material or quality of workmanship. The standard is the appearance of the product, its sale value and not its use value. As a rule, shoddy material leads to shoddy workmanship. In those subdivisions of a craft where machinery has not been introduced, the workmen have been forced to increase their product even to one-third, within the same number of hours, and at the same pay; to accomplish this result required the lessening of the amount of work on each article. Carelessness of workmanship follows this process, and soon the increased amount of product is turned off so easily that wages are reduced, because less skilled men will do the work cheaper.

Under these demoralizing conditions, workmen with any proper ambition will seek any other avenue for their sons than that of craftsman.

The demand for men in the service of transportation companies for a time appropriated a large number of young men from the craft pursuits, at wages less than the craftsman's, the difference and more than the difference in earnings being made up by the amount they were able to withhold from their employers. Clerkships offered freedom from the indignities of manual labor, and offered the same temptation of increasing their earnings by peculation. The cash register and other devices have reduced the income of the workers, and led to organization for increased wages.

The custom of giving "tips" and presents has made some low-wage occupations more desirable and profitable than many skilled trades.

The piece-work method of production, acting upon the workingman's ignorance of the laws governing wages, is operating in the same direction, — a reduction of wages and the increase of production at the cost of value to the consumers.

Unlawful pursuits are followed by hundreds and thousands of men who could and would have been good mechanics under such conditions as would make the exercise of skill in manual labor

easy of attainment and profitable and honorable in use. Petty larceny is the outcome of the pettiness of poverty, and grand larceny is the outcome of the same insane greed that promotes the speculative enterprises. Thousands of women are lost to society through the same failure of society to supply remunerative and pleasurable employment, and to recognize that it is more honorable to cook a good dinner than to preach a bad sermon. Superintendent of Police Byrnes of New York says: "There are forty thousand unfortunate women in New York, and a large part of them would lead respectable lives if they could secure employment and be treated like human beings. The greater part of this army is driven into degraded lives because they cannot make a living any other way."

The theory of the superiority of human development, of which the manual-training system is an important factor, is that labor is honorable, and that all men — laborers, clergymen, carpenters, teachers, track layers, bankers, bakers, cooks and concert singers — should have the fullest opportunity of development, physically, mentally and morally; that the woman who brings comfort and beauty to the home is more worthy of respect and adulation than the woman of society whose only claim is founded in the extravagant expenditure of money.

The distaste for manual labor is a natural and proper distaste, consequent upon its demoralizing effects physically as well as morally and socially. Educated laborers will aspire to more pleasurable and profitable employments, and through the leavening force of their increased power will vastly improve the conditions of the less educated.

Our public schools are for the training of citizens, not mechanics, merchants, lawyers or the other professions; and the youth is not correctly trained who enters upon the duties of citizenship with contempt for manual pursuits. He is not sufficiently trained for citizenship whose acquirements consist in memorizing terms, dates and events. To know how to compute interest on money is less important than to know how to earn a living; but to limit education to this acquirement is to degrade the man to the level of the

beast. Man must not be divorced from his duty to society. "Man has two selves; one his natural self, a puny individual, and another his higher self, embodied in institutions. Education is the preparation of the individual for reciprocal union with society, — the preparation of the individual so that he can help his fellowmen and in turn receive and appropriate their help."

"The pen is mightier than the sword" only when the pen transcribes grand and ennobling thoughts and sentiments, or truly describes things and events. To know how to read is important, but to know what to read and how to analyze it is an essential qualification for citizenship in a republic.

It is well to know how to measure verse, but it is important to know how to measure things, and yet more important to know how to measure the value of institutions. "If things and realities are the material of thought, what material of thought is so important for our examination as human institutional growth?"

The public school is a workshop, play-ground and civic society; its tools are books, maps, pens, paper and pencils; its studies should treat of men, customs, habits and institutions. The friends of the new departure, called manual training, would have the public understand that love in any work makes a thing of beauty, and that structures like the Brooklyn bridge are the Shakesperian verse of the nineteenth century; that statesmanship is grander and nobler than mere literary ability; that human institutions, habits and customs are man's created things, — processes of centuries of the best work of all.

The people should be taught that, as Emerson says, "It is genius' instinct to find beauty and holiness in new and necessary facts, in the field and roadside, in the shop and mill."

Hamerton writes that "Every art which is genuine, and the spontaneous expression of a people's taste and feelings, has in it some pressure and incommunicable quality, which is a part of the great mind of humanity, setting itself forth in the most perfect shape."

The argument that State training of its wards for citizenship should be limited to the mere ability to read, write and compute numbers, is based on a false theory.

Our free public schools are the primary training places of children and youth for citizenship, and that State fails in its duty to the present and future that limits such training to the mere text-book instruction in reading, writing, arithmetic, geography, history and grammar.

The public school is not the mere feeder of colleges; it has the larger and more important function as the feeder of the Commonwealth. As births into life supply the wastes by deaths, so births into education supply the waste by ignorance. The free school must not stand as the poor relation of the college, to be fed at the servants' table and patronized as a respectable pauper.

The free common school taught children and the free citizen soldiery are the unconquerable guardians of our liberties.

Citizen soldiers are instructed in the manual of arms by the use of arms, and their physical ability as an armed force depends upon the practice in use and not in memorizing the instructions of the manual. The militia are to be ready at call to use their knowledge to defend the State; they are equipped with weapons and disciplined in the skill of their use. They are seldom called to use their skill, but the training and the equipment are never neglected.

The children of the Commonwealth are trained in memorizing words, numbers, dates, descriptions and rules, but not in the knowledge of the use of such instruments, tools and appliances as are essential to protect themselves and the State when they are called into active life, or of the relations they bear to each other as members of one body.

The Commonwealth of Massachusetts stands for the common profession of all things, powers and opportunities that would make all its citizens sovereign possessors of common education and common wealth, in which "the self-activities of the individual must be strictly limited by the necessities of perfect central administration for the good of the whole."

The benefits of manual training will be found in increased ratio of the knowledge of the people "in pure science and humanity." Manual training does not mean trade training or tool

training. Tool training and tool knowing are the introductory methods of expanding the mind as well as educating the hand.

The demand for reform in methods of school training, and the extension of the curriculum to the knowledge and use of tools and their products, is not a new demand. The writer of this part of the report attempted twenty-two years ago to arouse public attention to the importance of the kindergarten and manual instruction. As some of the thoughts then expressed have received the seasoning of time, he inserts them here.

Observation and experience prove that if we would know how to teach we should first know how to learn, for "Out of the mouths of babes and sucklings proceedeth wisdom." It is because school committees examine teachers in their knowledge of text questions, instead of their knowledge of child natures, that so many truants are created.

The child loves to learn, and would soon exhaust our limited supply of knowledge if we could but listen.

It was no miracle that Christ, at twelve, confounded the doctors by asking them questions, as every father and mother can testify. But it would be a miracle if doctors of law and divinity, school boards and school committees, should learn how and what to teach from the hints of childhood and youth.

The babe teaches the mother how to feed it; the mother should know how much and how often. Nourishment for the body is the first requirement. How many prospective mothers are graduated with a knowledge of what is nourishing and what is not, of how to feed and how to clothe the little ones? Yet how many infants die annually because of ignorance upon these two important matters.

The next requirement is the knowledge of how to play. The piteous pleading of children hungry for amusement is heard in every household, — a pleading that soon changes to whining, crying and quarrelling, to be answered back with punishment.

At last, through tribulation and torment, the school age is reached, and sentence is pronounced, — five hours each day in the stocks, or desks, as they are politely called. Oh, the ache of body and mind of the little prisoner, as, seated bolt upright, his book of mystical characters, meaningless and void, lying open

before him, he tries to be a good boy, as mother told him. Thanks to the little active brain that so often plays truant, — leaving the unknown a, b, c, for the known realities of apples, berries and candy, — he is saved from being a fool. Listen to the joyful shout, mark the propelling power and vigor of new-found liberty, as homeward the youngster goes, causing parents to tremble at the thought of damaged clothes, bruised flesh and broken furniture, upon which outraged nature will repay itself. Unmindful of this daily recurring scene, thoughtless of results, we still go on, bragging of our great educational advantages, our excellent school-houses and teachers, of the great amount of money expended, of the excellent learning displayed on exhibition days.

Against this system, and the theory upon which it is founded, the kindergarten and manual training schools are intelligent protests, — protests too long unheeded, as a glance into the appropriations of the different States will reveal. Vast sums are annually given to colleges, where rich men's sons are educated; to normal schools, where the children of the middle class are graduated; and in many States not one cent for kindergarten or manual training schools.

As a result of this experiment, we may learn how to teach teachers and how to exhibit growth. Then shall the play of the children be looked after, and the barbarism of our school days be abolished. The money will show results of hardy, robust boys and girls, able to cope with life and its responsibilities, counting only idleness and listlessness degrading, ennobling labor to the high standing now held by the professions, and rendering some of the occupations and professions useless.

To do this is the work of time, but, once begun, the people will not turn backward. The first step, like a child's, will be but a feeble effort, but boldness and strength come with trying. Enough has been done to help the helpful; something must be done to help the helpless.

The children of the poor are the most helpless, and therefore should be the first to receive attention. The best help for the poor is to help them to help themselves, not by saying help, but by helping; and this must not be by a pauperizing charity, but by

rendering Christian justice. Justice to the poor does not mean annual or semi-annual presents from those higher in position; for, although presents among equals may be gratifying, gifts from superiors to inferiors are demoralizing, and dangerous to public weal. The laboring poor must be self-lifted from the debasing influence of poverty before they can or will render to civilization the full meed of its demands. The poverty of the parents, more than any other cause, compels them to rob their children of the weapon of self-defence, — education, — and leaves them with but brute force for protection.

The kindergarten teaches the children how to play, how to study, making all interesting, all instructive, all better. The manual training system teaches that manual labor is honorable and can be made pleasurable and profitable, and through a better knowledge of things gives us new and enlarged meaning to words.

We acquire language in proportion as we acquire knowledge of men, things and principles.

In the past, the accumulation, combination and arrangement of words in prose or verse, the translation of modern and dead languages into the language of the translator, constituted the chief work of the educated classes, or men of letters. Agriculture, commerce and manufactures were but crude methods of production and distribution, and any attempt to introduce wiser or better methods was looked upon with jealousy and distrust, and was met with legal and social opposition, on the plea of protection to home industry. Practically, every nation was surrounded by a Chinese wall to keep out the foreign and keep in the native products. Nevertheless, the inevitable law of distribution overcame all barriers, until commerce and manufactures, extending their sway over larger fields, made trade respectable, and created the demand for a business education, and for the first time practical mathematics competed with the classics. To-day the school and the college, though not yet emancipated from the past, are slowly learning the importance of a knowledge of things, as well as of words.

The college graduate enters upon the work of life ignorant of industrial operations. He is prepared for the library and study,

but not for the manufactory or for the duties of citizenship. The subject of his study and thought has rendered him less capable of competing with the young man whose school was the counting room, and whose teacher was the practical man of business. Let it not be understood that a neglect of the knowledge of words is advocated. It is the accompanying knowledge of their practical application that is needed. However excellent the grammar, however clear the expression of thought, words and thoughts are narrowed by the exclusive system that connects their use with composition alone. The importance of a knowledge of things cannot be over-estimated. All hail to Walt Whitman, whose verses keep pace with the whirr of machinery, the thud of the ship carpenter's hammer and the clicking of type into the printer's stick.

But it is not the colleges alone that are pouring into active life their half-completed products. The common school sends forth yearly its thousands of youth, who, shortly brought face to face with the occupations, social duties and responsibilities of life, stand back amazed before the terrible reality of their utter ignorance. How to apply the hard-gained knowledge of the school-room confuses them. What wonder at the demoralized condition of so many of the young. As well drill and discipline an army with the use of the bow and arrow, and marshal them forth to face the shot and shell of the cannon and Gatling gun, as to hope for success from the masses, armed as they are with the tools of study only, and not educated in the use or the application of their knowledge to self-help and mutual helpfulness. The implements of industry, their use and application toward these ends, are as an unknown language to them.

Is it a matter of wonder that distaste for the trades is everywhere manifest — that to be clerks, and not carpenters, is the ambition of those whose knowledge of the jack-plane and saw is derived only from the shaving-trimmed clothes of the father or the mutilated hand of a neighbor, while the clerk and the salesman, well-dressed and whole-handed, earn a living with the familiar pen of the school-room or the easy motion of a voluble tongue, aided by the graceful manners of youth? Will his sweetheart smile as graciously upon the blacksmith's apprentice as upon the

merchant's clerk? This is the important question he asks himself. All that he knows of the dignity of labor is from an occasional sermon of a high-salaried clergyman, or the smooth speech of a well-dressed merchant or spouting demagogue. The dignity of blacksmithing, brick-laying and painting disappear before the swarthy face of a son of Vulcan, or the mortar or paint besmeared overalls of mason and painter.

Bold as the assertion may be considered, it is true that the child is taught to despise manual labor, and that by the most subtle and convincing method, viz., by implication. His reading lessons are not of trade and commerce, of the processes of manufactures, of the wonderful manipulation of wood, iron, cotton and wool, of the grand achievements of the masses, but of the achievements of wealth or of glory. His arithmetic, nearer to common life than aught else, is of the counting room, not of the measure of lumber, or the application of algebra and geometry to wood-turning, jig-sawing, machine or house building. History contains little account of the success of the wage-laborers, as such, but rather of the achievements of warrior, orator and capitalist. Geography turns to plague him with his ignorance of his own State and nation. He knows how they are bounded, but not how they are peopled, what the people do to get a living, or of their relations one to the other.

What we want, then, is to commence at the beginning, among the masses, — the ignorant, degraded, because neglected, masses, — and provide an educational system that shall be, in the words of Dr. Harris, "the preparation of the individual for the reciprocal union with society, — the preparation of the individual so that he can help his fellow men, and in turn receive and appropriate their help."

It is the duty of the Commonwealth to commence the experiment of teaching the true dignity of labor and the dignity of citizenship. Let somewhat of the taxes go toward this desired purpose. Better lead in the van of this progressive age than to be overcome and trampled under the feet of the people, educated above honest toil but not above dishonest accumulation. For the danger is not wholly in the direction of the illiterate mechanic,

but in the unemployed classes, who look upon labor as disgraceful, and any method of procuring a subsistence without work as honorable. Does not the success of the adventurous speculator, stock and merchandise gambler, official speculator and irregular financier invite the thousands to new and untried fields of robbery?

The poverty of the parents and the greed of capitalists force the children to labor for the common sustenance; and, once at work under factory discipline, they are compelled, from the nature of the work, to follow the monotonous labor from morning till night, midst jar of machinery that tries the less tender nerves of older people, breathing air full of the scent of oil and wood, and, like delicate plants, fading away for want of sunlight.

The manual training system advocated by this Commission does not contemplate a course of training based upon the theory that children should be trained in such occupations or trades as the financial or social position of their parents would warrant. We agree "that the serious occupation of life cannot be imposed upon children without dwarfing their human nature, physically, intellectually and morally, and producing arrested development. Not only the games of youth, but the youth's freedom from the cares of mature life, should be insured to him, if the best preparation is to be made for manhood. It is sad to know that very many children are dwarfed by family necessity, which compels them to bear the weights and cares of mature years. The street gamin in the city is preternaturally acute, but is not in process of growth toward ideal manhood. Later on he will be found suffering from premature old age, in every respect a wasted human life, burnt out before it could develop its moral and intellectual ideals. He will have a 'Punch and Judy' face, such as Dickens ascribes to the stunted products of London street education. Students of anthropology tell us that man surpasses the animals so much in his mature life because he has a so much longer period of helpless infancy. He passes through a hundred grades of ascent above the brute, using all his forces in learning to walk on his hind legs, to use articulate speech for intercommunication, to dress himself in clothes, and to put on that far subtler clothing of customs and

usages which hold back and conceal his animal propensities, and substitute courtesy toward others for selfish, natural impulse. Were it not for this diversion of the forces of childhood, man might develop like the animals the ability to walk immediately after birth, and use his bundle of intellectual instincts at once, without the necessity of a long process of education."

A knowledge of things is a great aid in awakening not only consciousness of his higher self, but a stimulant to his dormant powers.

Proud as we are of the advance made from past conditions, we are yet neglectful of our duty to the children and the youth in the school and out of the school. But a small percentage of our youth enter the high school, and not more than half of those who enter complete the course. Not more than twenty per cent. of those who enter the grammar school remain long enough to graduate, and of all who enter the grammar school at least one-half will be found in the two lower classes.

The expansion of governmental functions that are certain to follow the present order of the industrial and financial system will find a constituency not qualified for the duties of self-government.

In the early part of the century, before the great subdivisions of labor, consequent upon machine methods and machine operations, a graduate of the district school was better qualified for his life duties than is the graduate of the school of to-day qualified for the enlarged duties upon which he is called to act, save where something of the new method has been adopted.

Some of the evils of continuous, monotonous labor have been lessened by increasing the age limit at which children can be employed, and reductions in the hours of labor; but this work must be supplemented by the filling of the time gained with opportunities of training the mind and body so that our youth shall know something of the why as well as of the how.

The Commonwealth should teach that labor is more than a mere commodity. Labor is the material life of the world, "Man's creative attribute."

"Work is the law of life, and its binding force upon the individual increases the progress of civilization. The savage must

work or perish, and the civilized man must work or compel another to work for him; and it is this alternative proposition that moulded, and still controls, with an iron hand, existing educational systems. We do not train men to be useful, but train them to make others useful. We assume the existence of class distinctions, and take measures to perpetuate them, by training men, not to work themselves, but to make others work for them. And this solecism in education is the more glaring in a country like ours, whose organic law asserts the equal rights of man. But every great abuse or ignorance, or superstition, has behind it a great cause, and the cause of this fundamental defect in our education dates back to Greece. The revival of learning was a revival of Greek methods, which grew out of a social system whose every attribute was the opposite of ours, — a social system whose corner-stone was slavery, as the corner-stone of ours is liberty."

"The philosopher may cease to speculate, the poet to sing, the lawyer to plead, the priest to warn, the doctor to heal, and the world, with all its multiform concerns, goes on. But let the hand of labor be unlifted, and there ensues an unfruitful pause. Silence in the field, the factory and the shop means want equally in the palace and the hut. And shall not the hand, whose cunning feeds, clothes, houses and warms the whole human race, — shall it not be trained?"

"A studied effort is now being made by the would-be taskmasters of mankind to re-enslave the laborer by treating his labor as if it were a mere commodity. But, while labor may be contracted for, it is not a commodity, because its delivery cannot be enforced. It is not a commodity, because no power can reduce it to possession in the hands of the alleged purchaser. It is not a commodity, because, notwithstanding the debtor may possess fifty years' store of it, not the smallest part can be extorted by legal process. It is not a commodity, because it is a spark of divinity, — man's sole creative attribute. As Carlyle well says, 'It is the truest emblem of God, and the predestined rule of the earth.'"

"Numbers of '*brainy*' persons have been graciously willing to do the thinking for the rest of mankind, provided the rest of mankind would house them, clothe them, feed them and otherwise

provide for all their physical wants. And it is worthy of note with what unanimity it has been agreed among the 'thinkers' that they ought to occupy all the fine houses, wear all the good clothes and eat all the delicate food; and they are equally agreed that huts, rags and corn-bread are good enough for the hand-worker. But it is none the less true, as Ruskin so pertinently says, that 'Your wealth, your amusement, your pride, would all be alike impossible but for those whom you scorn or forget. . . . The sailor, wrestling with the sea's rage; the quiet student, poring over his work or his vial; the common worker, without praise and nearly without bread, fulfilling his task as your horses drag your carts, hopeless and spurned of all, — these are the men by whom England lives.' Nevertheless, it is for the 'thinker' almost exclusively, and for the hand-worker not at all, that the schools have hitherto existed."

"Five hundred years ago famines came through failure of harvests and lack of transportation; but now they occur because a few, with avaricious hand, seize all the garnered fruits of labor. That this indifference to suffering among large masses of fellow-creatures is not natural, however, but the result of vicious education, is clear, since the humane impulse to deliver suddenly imperilled life is instantaneous, universal and overwhelming. When the spectacle of poverty or misery in any form shall prompt to saving action, as definite and vigorous as the voluntary impulse to rescue the drowning man is natural and irresistible, then and not till then will the race have attained a high moral plane."

Horace Mann in his last report says: "It is the blindest folly to contemplate men only as producers, to estimate only their productive capacity with that of perfected machinery; but, even if we were to narrow our vision to this microscopic view of the real issue, we should see, upon scientific investigation, that education is the essential element of success in the accumulation of material prosperity. It is a remarkable fact that human progress, even in regard to the worldly interests of the race, did not begin with those improvements which are most closely allied to material prosperity. One would have supposed, beforehand, improvements would commence with the near rather than with the remote. Yet mankind

had made great advances in astronomy and in geometry, and other mathematical sciences; in the writing of history, in oratory and in poetry; it is supposed by many to have reached the highest point of yet attained perfection in painting and in sculpture, and in those kinds of architecture which may be called regal or religious, centuries before the great mechanical discoveries and inventions which now bless the world were brought to light. And the question has often forced itself upon reflecting minds, why was this preposterousness, this inversion of what would appear to be the natural order of progress? Why was it, for instance, that men should have learned the course of the stars and the revolutions of the planets before they found out how to make a good wagon wheel? Why was it that they built the Parthenon and the Coliseum before they knew how to construct a comfortable, healthy dwelling-house? Why did they construct the Roman Aqueduct before they constructed a saw-mill? Or why did they achieve the noblest models in eloquence, in poetry and in the drama, before they invented movable types? I think we have now arrived at a point where we can unriddle this enigma. The labor of the world has been performed by ignorant men.

"As soon as some degree of intelligence dawned upon the workman, then a corresponding degree of improvement in his work followed. At first this intelligence was confined to a very small number, and therefore improvements were few, and they followed each other only after long intervals. They uniformly began in the nations and among the classes where there was most intelligence. The middle classes of England and the people of Holland and Scotland have done a hundred times more than all the eastern hemisphere beside. What single improvement in art or discovery in science has ever originated in Spain, or throughout the vast empire of the Russias? But just in proportion as intelligence — that is, education — has quickened and stimulated a greater and a greater number of minds, just in the same proportion have inventions and discoveries increased in their wonderfulness, and in the rapidity of their succession.

"For the creation of wealth, then, — for the existence of a wealthy people and a wealthy nation, — intelligence is the grand

condition. The number of improvers will increase as the intellectual constituency, if I may so call it, increases. In former times, and in most parts of the world, even at the present day, not one man in a million has ever had such a development of mind as made it possible for him to become a contributor to art or science. Let this development proceed, and contributions numberless and of inestimable value will be sure to follow. That political economy, therefore, which busies itself about capital and labor, supply and demand, interest and rents, favorable and unfavorable balances of trade, but leaves out of account the element of a wide-spread mental development, is naught but a stupendous folly."

The education of children, then, is the wisest means to secure material prosperity. Here in Massachusetts the danger is imminent, for here the population is more dense than the average of all other States taken together, and density of population has always been the proximate cause of social inequality.

"If this be so, are we not in danger of naturalizing and domesticating among ourselves those hideous evils which are always engendered between capital and labor, when all the capital is in the hands of one class and all the labor is thrown upon another?

"Now, surely, nothing but universal education can counterwork this tendency to the domination of capital and the servility of labor. If one class possesses all the wealth and the education, while the residue of society is ignorant and poor, it matters not by what name the relation between them may be called; the latter, in fact and in truth, will be the servile dependents and subjects of the former. But if education be equally diffused, it will draw property after it by the strongest of all attractions; for such a thing never did happen, and never can happen, as that an intelligent and practical body of men should be permanently poor. Property and labor in different classes are essentially antagonistic; but property and labor in the same class are essentially fraternal."

The hunger and thirst of the people for more knowledge, more wealth, more political and religious health, cannot be satisfied with learned dissertations upon obsolete educational, social and

economic dogmas, neither will the cry of economy drown the pleading voice of the child.

The little red school-house did its work well, because the cottage home, the little white church, the little shop and the town meeting were neighbors co-operating in the training of youth for the duties of life.

School-houses must keep pace with the large manufactories in equipment, and with the higher arts in beauty, and the school yards should increase in dimensions as the population becomes more dense. The play-ground should be a part of the educational opportunity for the children, as the Holmes Field of Harvard College furnishes opportunity for the physical culture of its students.

Church and State cannot and ought not to be united until, as in the days of the Pilgrims, all are of one faith; but the true religion of a common fatherhood and brotherhood can be revealed without dogma.

Homes will multiply as self-respect and self-dependence, through mutual respect and mutual dependence, increase.

The little shop has gone, but its beneficent educational influences can remain.

The school-house is a workshop, and the hand which learns how to use a pencil can be taught to draw pictures of use and beauty. From the mud pies to the clay maps is an easy gradation. The jack-knife, the plane and saw can be used with greater safety and to a wiser purpose under a system and an instructor than out of the school-house without an instructor, and this training will increase the interest of the pupil, not only in this work, but in the usual studies of the school.

The civilization of these closing years of the nineteenth century is materialistic. The order of so-called progress is toward aggregation rather than diffusion or distribution. Population flows toward the cities, wealth flows toward the few. Competition has become so fierce that combinations of the wealthy seek to drive out their weaker competitors. Factory is joined to factory, mine to mine and railroad to railroad, to destroy the competition which was their former boast. Other men combine to resist the downward tendency of the standard of their living, consequent upon the

competition of cheaper and more ignorant men. Contests between competitors have become frequent. Class is arrayed against class, and in this mad rush for wealth and mastery free institutions are endangered.

The machinery of to-day destroys the utility of the skill of yesterday, and the morrow brings no hope. The revolution now in progress will continue. Shall it come as a cloud, through the ignorance and despair of poverty, or shall it come through the peaceful processes and enlarged opportunities of education, freely furnished?

Recommendations.

We respectfully submit the following recommendations: —

1. That the principles and practice of the kindergarten be taught in the normal schools.

2. That the principles and practice of manual training, so far as applicable in the primary and grammar schools, be taught in the normal schools.

3. That the principles and practice of domestic science be taught in the normal schools.

4. That high schools, in which a course in the mechanic arts, approved by the Board of Education, shall be taught to boys, be established and maintained in all cities having a population of twenty thousand or more.

5. That high schools, in which a course in domestic science, including sewing and cooking, approved by the Board of Education, shall be taught to girls, be established and maintained in all cities having a population of twenty thousand or more.

6. Any city or town which, though not required so to do by law, shall nevertheless establish one or more schools for manual training or industrial education, open to boys or girls of fourteen or more years of age, and with courses of study and exercises approved by the Board of Education, shall receive from the State treasury an amount of money equal to the amount specifically appropriated by such city or town for the support of such school or schools in each and every year, provided the amount paid out

from the State treasury to any one city or town in any one year shall not exceed five thousand dollars.

7. That the State make provision for the training of teachers of the mechanic arts, by establishing at the Massachusetts Institute of Technology or at the Worcester Polytechnic Institute, or at both these institutions, State scholarships open to such young men as, being otherwise well qualified, shall promise to become, after their course of training, teachers in the public schools of this State.

8. That the duty of advising with and aiding school committees of towns and cities in relation to the introduction of kindergarten instruction into the public schools be made the special duty of an agent of the Board of Education.

9. That the Board of Education be by law required to appoint an agent whose special duty shall be to advise and aid in the introduction of manual training and industrial education into the public schools, and to visit and report upon all schools in which such training and education are carried on.

LOUISA PARSONS HOPKINS.
EDWIN P. SEAVER.
GEO. E. McNEILL.

APPENDIX.

Appendix A.

A PLAN FOR A MECHANIC ARTS HIGH SCHOOL IN THE CITY OF BOSTON.*

By EDWIN P. SEAVER, Superintendent of Public Schools.

The grade of the proposed school and its relations to existing public schools are best marked by naming it a *high* school, while the words *mechanic arts* indicate the characteristic feature of its course of study. The curriculum of this school, like that of the other high schools, should begin when that of the grammar school ends. It should be three years long. The requirements for admission should be a grammar-school diploma or the equivalent examination, age not less than thirteen, and a good character.

The school time, twenty-five hours a week, should be shared by shop work, book work and drawing, in about the proportion of ten hours to each of the two former and five hours to the last. But if it should be thought best to introduce military drill into the curriculum of this school, — and there are good reasons to be urged for doing so, — the needed time could be taken from the book work and the drawing equally. Then the distribution of time would be as follows : —

	Hours per Week.
Shop work,	10
Book work,	9
Drawing,	4
Military drill,†	2
Total,	25

Before speaking of the shop work in detail, it may be well to dispose of the other branches of the school work in a few words.

* Reprinted from Boston School Document No. 15 of the year 1889.

† If military drill formed no part of the instruction, the book work and the drawing would each be increased one hour a week.

The book work should be in English language, in mathematics, and in science; but a part or the whole of the science could be replaced by a foreign language, if circumstances made it desirable for any considerable number of boys to make such a substitution. This might well be the case with boys preparing to enter some higher institution of learning, as, for example, the Massachusetts Institute of Technology.

In English language, the chief effort should be in the direction of training to clear and correct use of language in both oral and written expression. Literature and history would not be directly the subjects of study in this department, but they would supply the material to be worked upon; and thus incidentally the pupils would become acquainted with a few works of the great writers.

The mathematics should include elementary algebra, plane and solid geometry, descriptive geometry and plane trigonometry. A thorough acquaintance with these branches has been found essential to the best success, both in drawing and in mechanical construction.

The science should be physics and chemistry. The method of teaching both these branches should be that known as the laboratory method. If circumstances make this method impracticable, — as is the case now in some high schools, — the time would be better spent in the study of a foreign language. The day for mere book work and lecture notes in science has gone by. Some of the apparatus used in the laboratories may be made in the shops by the boys, but not all. There is an important limit to be observed in this matter. Boys should not be set to making their own chemical or physical apparatus, unless the knowledge to be gained from such making be at least as valuable as the knowledge to be gained from any other kind of shop work that could fill the same time. To set boys to making things for no other reason than to save money in the running expenses of the school is wrong; for it is to sacrifice the boys to the school, whereas the school exists only for the benefit of the boys.

The drawing should be carried on with constant reference to the shop work, which it is designed to assist, and from which in turn it will receive assistance. As educational agencies, drawing and construction belong together as two parts of one whole. Neither is fully efficacious without the other. Like the two blades of a pair of scissors, each requires the aid of the other to do its own work. The drawing teacher will, therefore, keep the shop work constantly in view, co-operating with it, and using it as the chief source from which to take illustrations. The shop teacher, on his side, will see that every piece of work, however simple, be

executed from drawings made by the pupil. Thus the whole work of the drawing rooms and shops becomes one course of practice in the expression of ideas, through drawing and construction. The drawing will be chiefly of the kind known as mechanical drawing; but the æsthetic side of the work should be provided for by adding a reasonable amount of free-hand drawing.

The shop work will be described first in outline and then in more detail.

The first year's shop work should consist of carpentry and wood turning chiefly; but, for the æsthetic side of the work, there should also be a considerable number of lessons in wood carving. The year's work should be drawn up in a fully detailed series of lessons or exercises, which should be required of all pupils alike, the whole class beginning each new exercise in the series simultaneously. Then there should be drawn up a parallel series of supplementary exercises, to be given, as occasion may require, to those quicker pupils who complete the regular exercises in less than the allowed time.

In the shop work of the second year the wood-work is continued and becomes pattern making. This is accompanied and followed by a brief course in moulding and casting. The material used for casting may be either plaster or soft metal. The latter is easily managed, and may be melted over and over again, thus avoiding waste. The same may be said of brass. Although there appears to have been little experience with the casting and finishing of brass thus far in the schools, there is good reason for believing that experiments in this direction would prove very satisfactory. Iron cannot advantageously be used, for it would necessitate the expense and the trouble of a cupola. Besides, the process of iron casting, to be of much educational value, would involve more knowledge of metallurgy than could well be contemplated in a school of the character now proposed.

Whatever iron castings might be needed for the third year's work could best be procured at a commercial foundry in the usual way; that is to say, the boys would make the patterns of the castings they needed, send them to the foundry, and receive the castings in due time. It would, doubtless, be found practicable occasionally to arrange a visit to the foundry by a class when castings were to be made from their patterns, or at other times.

After the pattern making, moulding and casting, which altogether should occupy twelve or thirteen weeks in the early part of the second year, should come the forging, which will occupy the remaining two-thirds of the year. The forging begins with simple exercises in bending, drawing out and upsetting; then follows

welding, with exercises of increasing difficulty, requiring more and more knowledge and skill; and the course concludes with each boy's forging and tempering a set of tools which he will use next year in the machine shop.

Supplementary exercises in forging should be provided for the quicker boys. There is an endless variety of ornamental wrought-iron work that may be suggested for supplementary exercises, although some ornamental work should have a place in the required exercises. Thus the æsthetic side of the work would receive due attention. Ornamental wrought-iron work is now so much in vogue that the boys would find it very interesting, both in designing and in working out their designs. Their designs should first be made on paper, and submitted to the teacher for criticism.

Not until the designs have been approved does work at the forge begin. By this double process of making designs and working them out in material is the great lesson learned that mere prettiness, or beauty even, in a design is not necessarily an element of value. If a design be unworkable in the material intended, it is worthless.

The shop work of the third year should be almost wholly in the machine shop, consisting of exercises in chipping and filing and of exercises at the machine.

After the prescribed exercises of the year have been done, each pupil should be ready to undertake, either alone or in partnership with one or more other pupils, some project, or complete piece of mechanical work, which may serve as the crowning exercise of the whole instruction in mechanic arts. These projects correspond to the graduation theses of academic courses of study.

A project is begun in the drawing room, where the plans and shop drawings are prepared from given specifications. Then the patterns are made in the wood-working shops. The iron castings are best obtained at a commercial foundry, for reasons already explained. The pupils take the castings to the machine shop, where they do the fitting and finishing, and where the whole project is put together and tested. In this way the boys, in their third year, are taken over the whole ground of their previous instruction in mechanic arts, and their knowledge is unified and solidified. The projects usually undertaken by two or more boys in partnership are steam engines, dynamos, speed lathes, steam pumps, and other such machines. Some of the schools now possess machines thus constructed by pupils which have been doing good work for some years. At Baltimore is a steam engine, made by the pupils of the school, which furnishes all the power used in

the shops. At Chicago is a smaller engine, made in the school by pupils, which is used for driving some of the machinery of the shops. In the Naval School at Annapolis, where instruction in the mechanic arts is given to the cadets, there are good steam engines of various patterns, all the work of past graduating classes. At Cleveland is a forty-light dynamo, made by the boys, which will be used to light the machine shop.

Machines like these are undertaken only by several boys working together; for single boys the projects must be simpler and less time-consuming. As has been stated already, the boys' work on these projects begins with the preparation of drawings from *given* specifications. To originate designs of machinery, or to make specifications in accordance with scientific principles, would be too high a task for the boys to undertake at this stage of advancement. They must therefore take the designs and specifications of their projects from their teacher, or from some other competent authority. These having been obtained, all the rest of the work, save the casting, is the boys' own work, done under the general advice and guidance of the teachers.

Projects are not necessarily confined to the third year. They may be advantageously introduced near the end of the carpentry course in the first year, or near the end of the whole wood-working course in the second year, or near the end of the forging course in the same year. These would be especially desirable for those boys who had finished the prescribed exercises in an excellent manner, and in less than the allowed time. Boys of this sort there will always be; and the highest success of the school will depend on keeping such boys interested and busy. Pieces in cabinet making ornamented with wood carving, and pieces in ornamental wrought-iron work, would be quite within the boys' power to execute satisfactorily; and such pieces would serve well, not only to display acquired skill in workmanship, but also to bring into play the artistic feeling. As to the material used in any of the projects, if its cost should be worth considering, the boys should be expected to provide it or pay for it, in case they desire to possess the completed article. All projects, however, should be held by the school so long as they may be needed for exhibition.

Such in outline is the shop work which experience has shown to be practicable and useful, resulting in a good degree of general mechanical skill and a high degree of mechanical intelligence. The main features of this shop-work course may be regarded as permanent, although the details may be expected to change from year to year, as taste or convenience may suggest. Neverthe-

less, at the outset the proposed school will need a fully detailed course of shop work, showing all the particular exercises, both required and supplementary, together with suggestions of suitable projects for the end of the whole course and of other periods; and such a detailed course would be presented here in this report, with wood-cuts to illustrate it, were it not, fortunately, so easy to refer to a recently published book,* containing all the needed descriptions and illustrations. The exercises in carpentry, wood turning, pattern making, wood carving, forging, chipping, filing, shaping and finishing, fully described and pictured in this book, as executed in the St. Louis Manual Training School, leave little to be desired; and these may be adopted with all the more confidence, since the other schools have adopted substantially the same. For exercises in moulding and casting, reference may be made to the courses of some other schools, especially to that of the Massachusetts Institute of Technology. Also there are good examples of ornamental wrought-iron work to be taken from the schools at Chicago and Philadelphia. From these sources of information is derived the following brief statement of the contents of the various courses of shop work that should have place in the proposed school: —

1. Exercises in carpentry. Rip and cross-cut sawing. Pieces of rough stock sawed out to given dimensions. Planing pieces of board to given width and thickness, — true faces, straight and square edges. Squaring the ends of pieces. Nailing pieces together to form a box. Making a mitre box. Testing the mitre box by cutting four pieces for a square frame with mitre joints. Making a picture frame from a piece of moulding, — mitre joints. Paring with a chisel, (*a*) the end of a square piece in the form of a square pyramid, (*b*) the other end in the form of a semi-cylinder, (*c*) a circular disc from a piece of board, (*d*) an elliptical disc from a piece of board.† Joints: a half-and-half open joint, a half-and-half closed joint with pieces at right angles, the same with pieces at oblique angles (60° and 120°), a frame of four pieces joined with half-and-half closed joints with the projecting ends finished in semi-cylindrical form and the edges chamfered, an open mortise and tenon joint, a double open mortise and tenon joint, a closed mortise and tenon joint with projecting end of tenon rounded, a double closed mortise and tenon joint with projecting ends of tenons rounded, an oblique (45°) mortise and tenon joint, a half dovetailed joint halved together, a dovetailed joint with

* "The Manual Training School," by C. M. Woodward. Boston: 1887.

† If wood-working were pursued in the grammar schools, the earlier exercises in this schedule could be replaced by exercises of a more advanced character.

a single tongue, a half dovetailed mortise and tenon joint with a key, a half-blind dowel-joint, a small door with one panel, two pieces of board dovetailed together, a box dovetailed together (which may be a tool-box with the small door above mentioned for a cover), blind dovetails, a drawer. Completed articles like the following, which were among those made in one school by members of one class: oak tool chest, antique oak table, walnut footstool, cherry card box, shoe-blacking stool, bob sled, wall cabinet, centre table, book shelves, book case, mantel cabinet, music stand, wash bench, screen door, chiffonier. Several of these articles required wood carving as well as joinery, and would, therefore, be properly placed after the exercises in that branch.

2. Exercises in wood carving. These are from the Toledo Manual Training School, and are described and pictured in Woodward's "Manual Training School" (pages 68–71). Grooving or fluting across the grain; the same with the grain; the same both ways, the design being a series of rectangles, one within another; circular grooving; convex panel with tracery; engraved panel with flowing curves; long panel with engraved tendril; carved square panel; quadrifolium in relief; long panel with carved vine in relief; concave circular ground on square panel with design carved in high relief; carved diagonal panel with design of overlapping leaves sharply undercut.

3. Exercises in wood-turning. Turning a cylinder, a cone, a stepped cylinder, a double-stepped cylinder, a double cone, cylinders and cones combined, small cylinder between larger ones, convex beads, concave beads, sharp-pointed beads, long curves convex and concave and both combined, tool handles, balusters, table legs, dumb-bells, base-ball bats, hat pins, drawer knobs, and various other things of like kind; face-plate work, three or four pieces to illustrate the method, rosette, cylindrical and oval cavities; chuck work, as a hollow-stepped cylinder, rings and balls; extra pieces, as cups, goblets, saucers, napkin rings, croquet balls, hollow cylindrical or spherical boxes, and similar articles made of hard wood and finely finished.

4. Exercises in pattern making and moulding. Exercises in moulding with patterns already made (left over by last year's class), in order to learn the use of a pattern; three prescribed exercise patterns to be made from the pupils' own drawings, figured with the usual allowances for draft, shrinkage and finish; plaster casts of three patterns; from two to six other patterns (according to time and ability), each being tested either with plaster or with white metal; some of the patterns after being tested by plaster castings taken to an iron foundry, the iron cast-

ings there made to be kept for subsequent exercises in the machine shop.

Articles suggested for casting: a simple grate, a bracket, a crank arm, a hose nozzle, a straight-joint pipe coupling, an elbow-joint pipe coupling, a T-joint pipe coupling, a globe valve, a pillow block, a pulley, a sheave, a cone pulley. Also various ornamental or useful articles in zinc or brass.

5. Exercises in forging. All the more difficult exercises to be forged in cold lead before being forged in hot iron.

A bent ring (round iron); a bent double ring, or figure 8; the end of a rod bent in form of a ring; drawing out and upsetting, as in nails, staples and bolts; a hasp (tapering, bending and twisting); angle irons (flat bend and edge bend); a hook hanger; a bent brace; a fork; a trace-chain cross-bar (upset at middle and punched, ends tapered and bent); fuller piece (flat piece of iron fullered, drawn out at each end and swaged); round piece of iron upset at middle and squared; a lap weld; a tongue weld; a flat ring or ferule, welded; a welded eye; a piece of chain with welded links, ring, hook and swivel; welded bolt heads; a twisted open-work handle for fire tools; riveting (the handle riveted to a fire shovel); two pieces of boiler plate riveted together; a pair of blacksmith's tongs; a lathe dog; tempering; forging and tempering a set of machine-shop tools (cold chisel, threading tool, round-nose tool, side tool, parting tool, diamond point and inside tool). Also pieces of ornamental work, as hall lamps, lamp stands, window grating, fences, gates, cresting, etc.

6. Exercises in chipping and filing accurately to given dimensions. Material, cast iron.

A square prism or a cube, a rectangular block with chamfered edges, a hexagonal prism, a piece for interior finish of angles, two pieces fitted together with square tongue and groove, the same with dovetail tongue and groove (die block), two pieces halved together in form of a Greek cross, hexagonal bolt heads and nuts, a hexagonal wrench, slot-piece, valve seat, gears, chipping off rivets. Exercises with machine tools: some of the foregoing repeated with planer and shaper and finished with the file; also, a plain cylinder, a taper-piece, a right and a left handed screw, a finished handle, bolts and nuts, a lathe dog, a face plate, a pin and flanged nut, shaft couplings, a compass joint (pair of compasses or calipers), a try-square (for machinists' use), a jack screw, a bench screw, taps and dies. The latter part of the third year will be taken for fitting, finishing and setting up the steam engines, lathes, dynamos or other pieces of machinery that have been selected for final projects.

These courses of shop work are recommended as good courses to begin with, being the outcome of considerable experience; but there is no reason why desirable modifications may not be introduced at any time. Indeed, there is no school in which the shop work has been precisely the same from year to year. Small changes regarded as improvements are frequently made, but the main features have not been disturbed.

The accommodations necessary for carrying on the course of study above described consist of school-rooms, drawing rooms and workshops, with their appropriate adjuncts. In deciding on the number and size of these, there is one important fact to be kept in mind; namely, that each school desk, work bench and drawing table will be occupied by three different pupils in the course of a day; so that the number of desks, benches or tables need never exceed one-third of the number of the pupils to be accommodated. In the ordinary school, each pupil is allowed the exclusive possession of one desk, which he occupies all day, so that the number of desks must be equal to the number of pupils. But while, in the proposed school, two-thirds of the usual number of desks may be dispensed with, there will be needed some provision by which each pupil can keep his books safe from being meddled with while not in use. The same need will arise also in the drawing rooms and workshops; indeed, in every room the occupants of which change from time to time during a day or week. This need should be met by providing a system of lockers, — one locker for the exclusive use of every occupant of the room.

Two plans for doing this have found favor, which, for the sake of having names, may be called the *key-board plan* and the *drawer-rack plan*.

By the first or key-board plan, each bench, desk or table has as many locked drawers as it is to have different occupants, so that each occupant may have exclusive use of one drawer. All the keys belonging to the members of one class are kept on the class key-board; and this key-board is inaccessible at all times, except when the class is in the room. The teacher keeps the key-boards safe when not in use, and has as many of them as he has different classes in the room.

By the second or drawer-rack plan, each bench, desk or table is provided with one place in which a drawer may be kept while in use; but while not in use all the drawers are kept in a rack at the side of the room; the intention being that the drawers belonging to any one class shall be removed from the racks and placed in the benches, desks or tables at the beginning of the class session, and put back again at the end of the session. When the drawers

are placed in the rack, the teacher's key with one motion locks or unlocks them all. Thus the teacher's trouble in working the plan is very slight.

The choice between these two plans will be governed by circumstances. For example, when the drawers are large and heavy, as those containing carpenter's tools usually would be, the key-board plan would be the preferable one. But when the drawers are small, so as to be carried across the room without difficulty, the drawer-rack plan would have greater advantages. In school-rooms, since a school desk with three drawers in it large enough to be serviceable is an impossibility, the drawer-rack plan would be the only practicable one. The same plan has been found an excellent one for the drawing rooms and the machine shop; also for the blacksmith's shop, with the further advantage in the latter case that the drawers need not be taken from the racks.

The great merit of these two plans is, that they reduce the number of desks, benches or tables necessary for a given number of pupils to a minimum. The second or drawer-rack plan should be preferred whenever practicable, for it is the most economical plan yet devised for furnishing rooms that are to be occupied successively by different classes.

The next point to be considered is the size of the classes or divisions; for upon the number of pupils to be instructed at one time depends the number of desks, benches or tables in each room, and the size of the room. The experience of mechanic arts schools thus far seems to have fixed the number twenty-four as the largest number of pupils that can conveniently receive instruction at one time. Although in some book studies more than twenty-four pupils can be well instructed at one time, yet in the shop instruction, as in chemical and physical laboratories, divisions of twenty-four have been found fully large enough — sometimes even too large — for really profitable work. The time may indeed come when teaching skill in the mechanic arts will be as highly developed as it now is in the academic branches. When that time comes, it may be practicable to make classes in shops and laboratories as large as those in school-rooms; but for the present it would seem unwise to go beyond what experience has shown to be fairly within reach. Twenty-four pupils, then, should be assumed as the basis for determining the number of desks, benches or tables in a room; and these in their turn will determine the size of the room.

As each room would be occupied in the course of the day by three different divisions of twenty-four pupils each, the total capacity of a room furnished with twenty-four places would be seventy-

two pupils. Thus, a class of seventy-two members would need for its whole work one school-room, one shop and one other room, which other room would be either a drawing room or a laboratory. Assuming that the school to be provided for would have a course three years long, and therefore three classes, — junior, middle and senior, — each with seventy-two pupils in three divisions, or two hundred and sixteen pupils in all, there would be needed three school-rooms, three shops and three other rooms, or nine rooms in all. These rooms would be occupied all the time, and would constitute the least provision that would meet the conditions of the case. But the number of rooms actually found necessary by reason of the different kinds of work to be done is somewhat greater, — four shops instead of three, and four other rooms (that is, two drawing rooms, a chemical and a physical laboratory) instead of three; or, in all, eleven rooms instead of nine. Such would be the provision for a school of two hundred and sixteen pupils. A smaller school could hardly do with less; but a school of double the size would not need to duplicate the whole provision.

The school-rooms, drawing rooms, chemical and physical laboratories need not be particularly described in this report, since no special modifications in such rooms have been found necessary to adapt them to the wants of a mechanic arts school.

But the shops, being a wholly new feature in school accommodations, need to be described fully. They are: —

1. The first wood-working room, or carpenter's shop.
2. The second wood-working room, or pattern-maker's shop.
3. The first metal-working room, or blacksmith's shop and foundry.
4. The second metal-working room, or machine shop.

Necessary adjuncts to these are the engine room, the boiler room, a store room for lumber near the wood-working rooms, a moulding shed near the foundry and wash rooms. The best shape and size for all four of the shops would be thirty-six feet wide by forty-eight long. These dimensions are large enough, but two feet more each way would not be space thrown away. The shops should all be high, well lighted (on three sides if possible) by windows running clear to the top. There should be as much window space as possible, consistent with due strength in the walls of the building, for abundance of light is a matter of the very highest importance. In planning a new building, this consideration would govern all others except the stability of the structure.

Another matter of some importance is the placing of the rooms relatively to one another. Two of the shops are to be furnished

with machinery and two are not. By placing the two latter together in one wing a freedom from the troublesome jar of machinery is secured for that wing. Here the drawing rooms should be placed ; for it has been found that drawing rooms placed over moving machinery are seriously troubled by the vibration.

Again, it is important that the two wood-working rooms should be of easy access the one from the other ; and the same advantage is even more important in regard to the two metal-working rooms. This advantage would be secured by placing the two metal-working rooms in the first story, and the two wood-working rooms in the second story. Then, by placing the blacksmith's shop under the carpenter's shop, one side of the building would have no machinery. Between the shops on each floor would be placed the wash rooms,* together with the lumber store room above and the moulding shed below. But further details with regard to the arrangement of a building would seem uncalled for, and may well be postponed until the prospect of an actual building to be arranged becomes immediate. Meanwhile, attention may be directed to the furnishings of the four shops, — the benches, the tools and the machinery, — all of which would be the same, in whatever building the shops were placed.

1. The first wood-working room, or carpenter's shop, should contain twenty-five carpenter's benches — one being for the teacher — and one grindstone.

Within easy reach from both wood-working rooms should be a circular saw and a jig saw. These saws are not for the teachers' use alone ; the boys should be taught to use them with care. The benches should be placed with head to the light, and the teacher's bench should have a space behind it where the whole class can gather occasionally to receive instruction. The best dimensions for the benches are six feet long, two feet wide, and thirty, thirty-two and thirty-four inches high. The different heights are for boys of different stature.

The top of the bench should be a thick hard-wood plank, which may be removed occasionally and given a new smooth surface. Each bench should be provided with a good carpenter's vise — jaws long and on a level with the top of the bench — and with one drawer to hold the tools that belong with the bench. Then there would be needed seventy-two other tool drawers, to contain the tools for which each pupil is held individually responsible. These

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* Since this was written the plans for the Mechanic Arts High School in Boston have been drawn, providing ample washing facilities and individual clothes closets in the well-lighted basement. This is believed to be a better plan than the one above suggested.

seventy-two drawers would be placed either in the benches, three in each bench, or in racks at the side of the room, according as the "key-board plan" or the "drawer-rack plan," already described, should be adopted for this shop. Under the key-board plan each bench would have four drawers, one for the bench tools, which need not be locked, and three for individual tools, which should be kept locked with keys that are kept on the class key-board. This may be the preferable plan ; but if carrying the rather large drawers of tools across the room at the beginning and end of every lesson be not considered a serious objection, there may be an advantage in the drawer-rack plan ; for under that plan each bench would have but one drawer, — that for the bench tools, — and a place for holding another drawer while its owner was working at the bench. Thus there would be room under the bench for a pair of trestles, and the inconvenience of using lower drawers would be obviated. But the choice between these two plans might turn on circumstances not now foreseen. Either plan would be preferable to the plan hitherto usual, by which the bench tools are kept on a tool board attached to the bench, extending nearly its whole length, and rising above its top about two feet. These tool boards are seriously inconvenient in several ways, and the problem has been how to get rid of them. Either of the plans above suggested is believed to be a satisfactory solution.

As already implied, there is a classification of the tools to be supplied in the carpenter's shop. There are, first, the tools which the pupil needs to have constantly within reach, but which are not likely to be kept in good condition unless some one is held individually responsible for them. These are planes, chisels and gouges, — indeed, all edged tools that are in constant or frequent use. Such tools are issued to each pupil at the beginning of a term, and are kept by him in the drawer provided for his individual use, as above described. They may be called *individual tools.*

Then, secondly, there are tools which the pupil needs to have constantly at hand, but which need no special care to keep them in good condition. These are hammers, mallets, chalk-lines, try-squares, compasses, screw drivers, etc. They are issued one to each bench, and may be called *bench tools.* They are kept in the drawer provided for them.

Thirdly, there are the tools which are not in constant or frequent use, and which may be kept in the teacher's tool closet, thence to be issued on check to the several pupils who may need occasionally to borrow them. These may be called *occasional tools.*

Of the occasional tools, one or two of a kind would generally be found a sufficient supply for the whole shop. Of the bench

tools, there would be needed as many of each kind as there were benches; and of the individual tools, as many as there were pupils.

To provide so large a number of individual tools is somewhat costly, but seems not uncalled for. There has been some experience on this point worth considering. There are schools in which no provision of individual tools is made, the edged tools in most frequent use being supplied only as bench tools. The economy of such a plan is evident, but the great objection to it is the practical certainty that the edged tools so used will be constantly in bad condition. A boy finding the plane dull will not be disposed to take the utmost pains to put it in perfect order, and leave it so, if he knows that before he will use it again others will use it and leave it dull; but if he can be secured the full benefit of his pains in sharpening his tools, he will be disposed to keep them always in the best of order. This is what we might have expected beforehand, and experience has realized the expectation. Now, it is well known that accurate joinery depends on the sharpness of the cutting tools, — good joints cannot be made with dull tools, — and it is an observed fact that the quality of the carpenter work is distinctly better in those schools which provide each pupil with a kit of edged tools for his exclusive use.

The extra outlay required by such provision of individual tools seems fully justified by the better results that are sure to follow. Without this provision it seems hardly practicable to teach the boys that best accomplishment of a good workman, — the art of keeping his tools in perfect order.

The following lists of tools are given as approximate statements of what may be needed. The third list, consisting of special tools for occasional use, could be extended at moderate cost, as needs might arise.

Lists of tools for the carpenter's shop: —

(*a*) Individual tools, one for each pupil: jack plane, jointer (22″), smoothing plane, block plane, set of chisels ($\frac{1}{4}''$, $\frac{1}{2}''$, $\frac{3}{4}''$, 1″, 2″), gouges ($\frac{1}{4}''$, $\frac{1}{2}''$, $\frac{3}{4}''$, 1″).

(*b*) Bench tools, one to each bench: cross-cut saw (20″), rip saw (20″), back saw, claw hammer, mallet, try-square, bevel, compasses, marking gauge, mortise gauge, two-foot rule, small steel square, nail set, screw driver, bit brace, oil stone, oil can, bench brush and pair of trestles.

(*c*) Occasional tools, one, two or more of a kind, as may be needed: hatchets, draw shaves, spoke shaves, wood rasps, wood files, compass saws, bits of all sorts and sizes, monkey wrench, clamps, pair matching planes, beading planes, moulding planes,

rabbeting planes, plough, fillister, and as many full sets of wood-carving tools as might be needed.

The tool closet is intended for both wood-working rooms, hence the foregoing list is fuller than would be necessary for one room alone. In the tool closet should be kept a supply of glue, sand-paper, shellac, stains, varnish, nails, brads and screws.

The cost of the benches and tools for the first wood-working room, as above described, should not exceed $1,500.

2. The second wood-working room, or pattern-maker's shop. This should be furnished with benches and tools in much the same way as the other shop was furnished, with the important addition, however, of twenty-four wood-turning lathes. In some shops the lathes are attached to the benches, which, for economy of space, are made double; but a better arrangement appears to be to place the lathes by themselves around the edge of the room near the windows, and then to place the benches so that each one may stand near a lathe, thus allowing the boy using both to step readily from one to the other. By this arrangement the boys are not exposed to each other's turning chips, as they are when the lathes are attached to the double benches.

If the room be well lighted, the benches may be placed far enough away from the windows to allow the lathes to be placed as proposed. The benches in this room are in all respects like those in the carpenter's shop, except that the vises are of the variety known as coach-makers' vises, the jaws of which are some six or eight inches above the top of the bench.

The tools to be supplied to this shop are substantially the same as those supplied to the carpenter's shop, with the addition to the individual tools of a few tools for turning. The turning tools should be two turning gouges ($\frac{1}{4}''$, $\frac{7}{8}''$), two turning chisels ($\frac{3}{8}''$, $\frac{7}{8}''$), one parting tool, one round-nose tool, and one pair of calipers ($5''$). Any other tools that may be needed may be added to the occasional tools already provided in the carpenter's shop, the closet containing them being accessible from this shop as well as from the other.

The cost of furnishing the pattern-maker's shop in the manner described should not exceed $2,000.

3. The first metal-working room or blacksmith's shop. This shop will necessarily be placed on the ground, for it should have no wooden floor; and the anvils should be mounted on posts running down some four feet into the ground. Twenty-four anvils, twelve double forges, a teacher's anvil and forge, hoods over the forges, smoke pipes and an exhaust fan to draw out the smoke are the furnishings required for the principal business of this

room. If metals of any kind are used for casting, the melting furnace should be placed in this shop and the casting should be done here. The moulding trays are stored, when not in use, in some adjoining room or shed; but when in use some of them may be placed temporarily in this shop. Hence, the whole provision for moulding and casting may be considered as belonging to the first metal-working room; in other words, this room is a foundry as well as a smithy. As already stated, the use of iron for casting is not contemplated.

The tools needed for forging are all of the kind named *bench tools;* that is, all the occupants of one forge use the same kit of tools. There is no reason for providing *individual tools.*

The tools at each forge are one anvil (84 pounds), blacksmith's hammer ($1\frac{1}{2}$ pounds), four pairs tongs ($\frac{1}{4}''$, $\frac{3}{8}''$, $\frac{1}{2}''$, $\frac{3}{4}''$), a poker, a rake, a shovel, a sprinkler, a hardy, a steel square and a leather apron. One sledge to two forges. Occasional tools, as cold chisels, punches, etc., are not numerous. Moulding trays should be $4\frac{1}{2}$ feet long by $1\frac{1}{2}$ feet wide and 1 foot deep, the top being about 30 inches from the floor. Over one end of the tray should be placed a movable board $1\frac{1}{2}$ feet square. The backs of the trays may come up high enough to hang the tools on, provided they do not obstruct the light; but if they do they should be dispensed with.

The tools needed for moulding are a small shovel, a twelve-inch brass-wire sieve ($\frac{1}{8}''$ mesh), a moulder's trowel ($1'' \times 4''$), a quarter-inch lifter, a draw spike ($6''$ long, $\frac{1}{4}''$ diameter), a larger draw spike ($8'' \times \frac{3}{8}''$), a vent wire, two rammers ($1\frac{1}{2}''$ and $3''$ diameter), a dredging-box, several conical wooden plugs, a straight-edge, a small sponge and a small square piece of tin bent to form a gate cutter. Most of the moulder's tools can be made by the boys, and so may some of the blacksmith's tools. The making of a pair of blacksmith's tongs, for example, is an excellent exercise in forging, and the product is usually worth keeping for use. The turning of wooden tool handles is a good exercise towards the end of the first year in school. The second year's work includes the making of a number of tools that will be used in the blacksmith's or the machine shop.

For the forges, anvils, moulding trays, blacksmith's and moulder's tools a safe estimate is $1,200. For the smoke pipes, exhaust fan and power blast necessary for ventilating the room and blowing the fires no close estimate can be made until the conditions of the actual room to be ventilated are known. But allowing $1,300 for this, the total estimate for this room will be $2,500.

4. The second metal-working room, or machine shop. This

shop is furnished with a machinist's bench around the outside of the room, and with machinery filling the rest of the floor space. On the bench are twenty-four machinist's vises, and underneath are drawers for the bench tools and places for other drawers, which are kept in a drawer rack. These drawers are not large, and so the drawer-rack plan will be convenient for the machine shop. The bench on one side of the room should be lower than that on the other, and the shorter boys should be placed at the lower bench.

The machinery should consist of twelve engine lathes (some larger, others smaller), four speed lathes, one planer, one shaper, one goose-neck drill, one post drill, two emery grinders and a gas forge. The *bench tools* consist of a machinist's hammer, a pair of compasses, a pair of calipers, a measuring scale and a set of files. The *individual tools* are the tools made by the pupils the preceding year for use in the machine shop. They are cold chisels, centre punch, centre chisel, threading tool, round-nose tool, side tool, parting tool, diamond-point tool, inside tool. These were forged and tempered last year. This year they are to be ground to the proper shapes and kept in good condition under the teacher's directions. The *occasional tools* to be issued on check are not numerous, and may be supplied as needs arise.

The cost of the machinery will vary widely, according to the different patterns and sizes and with different makers; but with any machinery at all suited to the purposes in view the expense of furnishing the machine shop will be large. The opinion of those who have had experience is that small and cheap machines are not worth buying. Solid machines of the best construction are needed to stand the wear and tear of school shop use. Indeed, the same remark applies to all the machinery and all the tools throughout the shops. They should all be the best of their kind. Inferior tools are not easily kept in good order, and inferior work is the result. It is not safe to estimate the expense of tools and machinery in the machine shop at less than $6,000.

Estimates for the wash rooms would depend so much on the plan and style of plumbing adopted and on local circumstances that they may here be omitted. Caps, aprons, blouses, overalls, soap and towels should be kept in the individual drawers in the two wood-working rooms, for there the drawers are large enough to hold these things; but in the blacksmith's shop, and possibly in the machine shop, pigeon-holes should be provided for the purpose. In these pigeon-holes or in the individual drawers, as the case may be, are to be kept any unfinished pieces of work the teachers may prefer to have cared for by the pupils themselves.

Such are the four shops, with their furnishings and the tools. These shops are not fully occupied all the time, for there are four shops and only three classes. But it does not appear to be practicable to carry on the proposed work in fewer shops. To explain briefly how the shops would be occupied, let the school year be divided into three equal terms, say of thirteen weeks each. A class in passing through the school in three years would spend the nine terms as follows: the first and second in the carpenter's shop, the third and fourth in the pattern maker's shop, the fifth and sixth in the blacksmith's shop, and the seventh, eighth and ninth in the machine shop. Thus, apparently, the carpenter's shop would be vacant in the third term of the year, the pattern shop vacant the second term, and the blacksmith's shop the first term. But these shops would not be wholly unoccupied in the terms mentioned, for the boys in the pattern shop during the first term of the year would use the blacksmith's shop to some extent for moulding and casting, and boys in the machine shop during the second term of the year will need to use the pattern shop to some extent in making patterns for their projects, or during the third term of the year might need occasionally to use benches in the carpenter's shop. Thus the provision of four workshops for three classes appears to give no more than a reasonable margin for convenience in working.

. . . .

As regards organizing the school, it may be assumed that the full school of three classes would not be in operation until the beginning of the third year, and the full equipment of tools and machinery would not be needed until that time; but, on the other hand, it will be necessary to order the machinery six months or a year in advance of the time when it will go into use.

At the start the school would need to have ready one school-room, one drawing room, and the *second* wood-working room, with its benches, lathes and tools. This would provide for the shop work for one full year and some weeks of the second year, assuming, as already explained, that the entering class would not exceed seventy-two in number.

At the beginning of the second year the *first* wood-working room should be ready; and then, or very soon afterwards, the blacksmith's shop; both with their outfit of tools, including also trays and tools for moulding, and the melting furnace. Another school-room would also be needed at this time.

At the beginning of the third year the machine shop should be ready; also another school-room and a second drawing room. Thus the full school of two hundred and sixteen boys would be

provided with rooms, except in the matter of chemical and physical laboratories. If foreign language should take the place of these sciences in the course of study, — which has been left an open question, — then these laboratories would not be needed. It is also possible that one of the drawing rooms might be large enough to accommodate the work in physics. Therefore the provision of the chemical and physical laboratories may be left an open question for the present.

Respecting the appointment of teachers, it may not be out of place to remark on a few points of prime importance. The principal of the school should be a man in thorough sympathy with the kind of work the school is to do. If he should have some practical knowledge of shop work himself, so much the better. He should be a man of full academic training, a man of experience, and accustomed to the management of large schools. He should have supervision and control over the entire school in all its branches of work. His rank and salary should be equal to those of other high school principals of the city.

After the selection of the right man for principal, the next most difficult matter will be the finding of entirely suitable persons to be assistants in the different branches of shop work. To find a good carpenter, a good blacksmith or a good machinist is comparatively an easy matter. But this is not enough. The men selected must possess the faculty of imparting their knowledge to classes. They must possess the essential qualifications of a good teacher, — must know not only the art they would teach, but the art of teaching. Sometimes it happens that a practical mechanic has had in his youth a thorough academic and even a collegiate education. If such a person could be found who also had the gift of teaching, his combination of qualifications would be the best. The discovery of such persons may appear difficult, but it is not a hopeless task; in proof of which might be named a college graduate, who, after taking his degree, passed seven years in a machine shop, and is now a highly successful teacher in a mechanic arts school. Still, it must be recognized that the happy combination of all the desirable qualifications is rare, and cannot reasonably be insisted on.

What ought, however, to be insisted on as absolutely essential, is that any assistant teacher, in whatever capacity employed, should have the habit of using the English language clearly and correctly. Too much emphasis cannot be laid on the importance of taking care lest the introduction of sewing, of cooking, or of manual training in any form into the schools become a source of injury to them, through the appointment of persons to teach

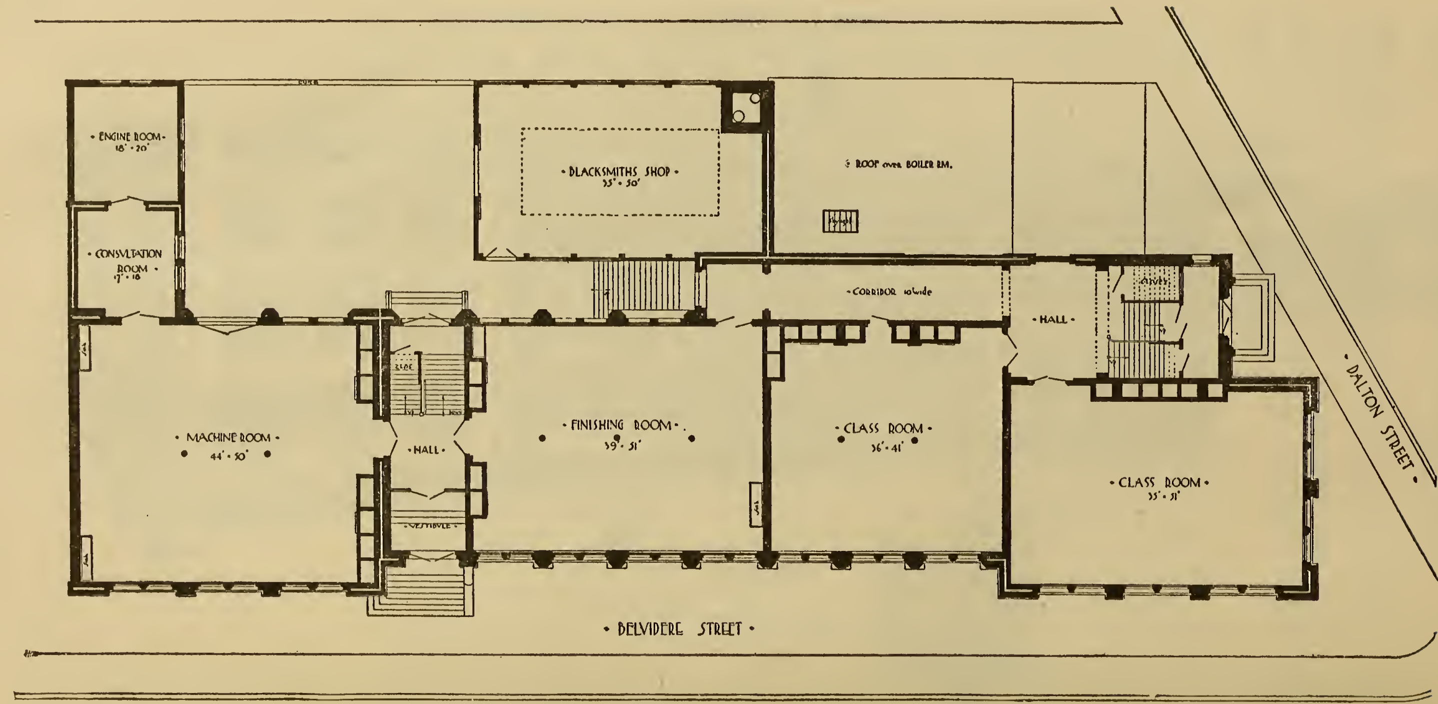
these things whose instruction would be conveyed in ill-chosen or incorrect language.

Of course it needs no pointing out that the moral character and personal habits of any person appointed to teach anything should be wholly unexceptionable.

NOTE. — In submitting the foregoing report to the Boston school committee, the writer made use of the following language touching the name of the proposed school: "In closing this report, I wish to make one remark about the name to be given to the proposed school. I have used [in describing my visits] the name by which all the schools visited are designated — the *Manual Training School.* The name has obtained wide, almost universal, currency during the last eight or nine years. I have elsewhere given my reasons for preferring a more truly descriptive name, the *Mechanic Arts High School;* and this name has been used by me in the preparation of the [above] plan. But now the feeling comes upon me that, in view of the wide currency the other name has already obtained, it might justly be deemed pedantic to persist in the use of a name which up to the present time has not been affixed to any school of the kind denoted. I wish, therefore, to leave the question of name an open one, still believing in the validity of the reasons I have adduced in favor of the more truly descriptive name, the *Mechanic Arts High School*, but ready to bow to usage, the arbiter in all questions of language, if it should be thought best to adopt the other name."

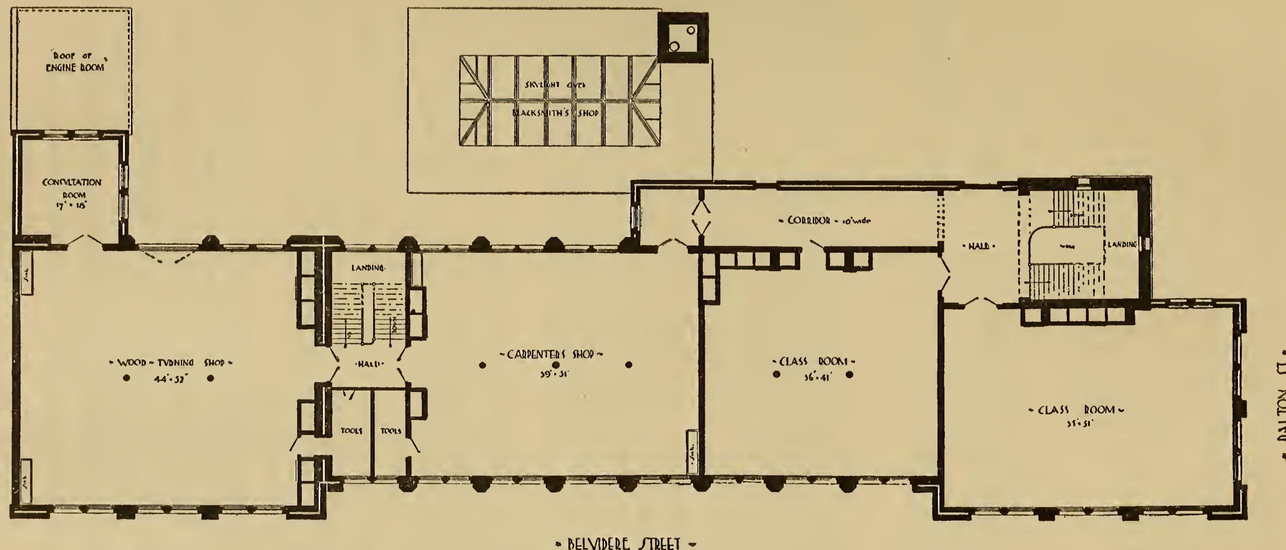
This was written in 1889, since which time the question of name has received consideration, and the *Mechanic Arts High School* has been adopted. Perhaps the main reason for this conclusion is the fact that the term *manual training* has come to be used with a very broad application, — much too broad to be safely employed to designate the rather specific nature of manual instruction in high schools. That instruction, in so far at least as boys are concerned, relates to *mechanic arts*, and to nothing else. Hence the term *mechanic arts* is the best specific epithet to use. Moreover, the term *high school* is needed to mark the place or rank of the school in the system of schools. It stands above grammar schools, and side by side with the Latin high schools and the English high schools.

MECHANIC ARTS HIGH SCHOOL, BOSTON.



MECHANIC ARTS HIGH SCHOOL, BOSTON.

FIRST FLOOR.



MECHANIC ARTS HIGH SCHOOL, BOSTON.

SECOND FLOOR.

APPENDIX B.

MANUAL TRAINING IN BROOKLINE.*

BY JOHN D. RUNKLE, MEMBER OF THE BROOKLINE SCHOOL COMMITTEE.

This report of a concrete case of the introduction of manual training is offered as an example, and perhaps as an aid and guide, to those who may wish to modify their public school instruction in the same direction.

At the same time, it is believed that the value of systematic training in hand-work, as an important factor in mind training, is so fully recognized and admitted that it will not be necessary to devote much of this report to this phase of the subject. It has become a question of how, rather than why; and it is obvious that the steps here outlined must be modified to meet the conditions of special cases.

About the year 1880 it had become apparent that the Ward Grammar School must soon have a new building; and, further, that the proposed Muddy River improvement would in a short time make it necessary to select a new site for this school. In connection with these conditions the school committee and a few others were led to the consideration of the importance of a modification of the course of study for this school when it should be removed to its new quarters.

Very naturally, attention was turned towards the subject of manual training as a part of a grammar-school course of study. At this date the methods to be followed in technical and other advanced schools had already taken pretty definite shape; but it was still an unsettled question as to what extent, if at all, these methods could be utilized in the grammar and lower-grade schools, as an integral and definite factor in their courses of instruction.

* A Report on the Introduction and Progress of Manual Training in the Public Schools, prepared at the request of the Commission on Manual Training and Industrial Education.

It became important, therefore, to get, if possible, some experience to guide the committee when the time should come to take action in the matter, and it may be well to include a brief account of the tentative steps which were taken to this end, as shown in the successive reports of the school committee. As these reports were drawn up by the writer of this paper, they may without impropriety be freely used in this connection.

During the school year of 1880–81 the school committee referred the matter of vacation schools to the advisory committee, — a committee of ladies to whom it had been customary to refer such questions relating to the schools of the town as needed special attention, and were not at the time a necessary part of their current work.

It was finally decided by the advisory board to establish a vacation school of carpentry for boys, the age of admission to be not less than twelve years. The expense of this first experiment was borne by private subscription. The only part of the report of the advisory board for the year relating to this matter is as follows: —

> The trial of an industrial vacation school last summer, after the inevitable mistakes of an experiment were conquered, proved a success, which we hope very much will be recognized by the town, and that money will be appropriated for the regular maintenance of such teaching for the boys.

The town, in accordance with this advice, voted the sum of $250 to continue the school during the summer of 1882, and the school committee appointed a special committee to co-operate with the advisory board.

It ought to be added to the above statement of the advisory board that the first experiment was beset by three grave difficulties, — that of finding a suitable teacher, of irregular attendance and of poor facilities.

The sub-committee say that, in entering upon the duty of aiding in the direction of this school for the summer of 1882, the first concern was to find the proper teacher. Learning that Mr. George P. Hildreth, who had during the preceding summer taken charge of the school for the last month, and had substantially secured for it the measure of success it had gained, was willing again to take the place of instructor, we had no hesitation in appointing him. It is only just to Mr. Hildreth to say that whatever of success we are able to report is due to his skill as a mechanic and to his faithfulness and aptitude as a teacher.

But the circumstances were still largely adverse. The whole number of pupils registered was 63. Of these, 8 took but one lesson; 3, two; 7, three; 7, four; 7, five; 3, six; 3, seven; 3, eight; 1, nine; 1, thirteen; 2, fifteen; 1, sixteen; 2, seventeen; 1, twenty-three; 2, twenty-five; 1, twenty-six; 2, twenty-eight; 1, thirty-four; 2, forty; 1, forty-one; 2, forty-four; 1, fifty; and 1, seventy-four lessons. It thus appears that only 13 of the whole number of pupils took twenty-five lessons and above, 42 took less than ten and 32 took five or less.

Some of the ill effects of this irregular attendance are obvious. First, much time was wasted with pupils who took too few lessons to profit by the instruction; second, it prevented in a large degree the laying down and following a progressive series of lessons, thus impairing the instruction; and third, a much larger number might have been successfully taught if the attendance had been regular.

The school was divided into three sections, each section having a two-hour lesson each day except Saturday. The lessons began at eight and ten A.M. and at two P.M.

From the attention we were able to give during the progress of the school, and at its close, we felt assured of its substantial success as a whole, and its marked success in special cases.

We believed the town would gladly furnish the small sum needed to continue this vacation school, and at the proper time would make this kind of instruction a part of the required work in such schools of the town as needed it. If this instruction could be continued during the whole of the grammar-school course it would give a large number of boys proficiency in hand-work, without in the least impairing the amount and quality of the usual acquirements. Not more than two short lessons per week, continued for two or three years, in a few well-arranged courses of hand-work, would produce results which not long since would have been thought impossible.

We recommended that in future no pupils should be admitted to the vacation school whose parents did not apply in person for such admission, and promise that, if admitted, the attendance should be regular.

Notwithstanding the above pledge on the part of the parents, and in addition the offer of six prizes varying in value from two to three dollars each, for the summer school of 1883, the whole number of applicants admitted was only 36. Of these, 12 were dropped for irregular attendance, and 3 took less than twenty-five lessons. The remaining 21 took from twenty-five to ninety-four lessons each, and made, upon the whole, satisfactory progress.

We quote a few sentences from the close of the report for this year: —

> While a larger number of pupils profited by the school than in the previous year, the number seeking admission did not come up to our expectations.
>
> It is evident that instruction in a vacation school can never take the place of the current work during the remainder of the year in any department; and the most we have hoped to do is to demonstrate the feasibility and value of hand teaching, in order that at the proper time the town might be ready to adopt it as a part of the educational training which it would demand of all pupils needing it, either as a means or as an end.
>
> Special mechanic arts schools, or manual training schools, are rapidly springing up in many of the larger cities in all parts of the country; and we earnestly hope that Brookline may be among the first, if not the first, of towns to recognize the value of this kind of teaching by requiring it as a part of the pupils' fundamental education.

The school was opened again on July 8, 1884, and continued ten weeks, closing September 13. The work benches were shortened to six feet, and arranged for two pupils to each. Such new tools as were needed were bought, and everything was done that seemed necessary to secure success, with proper attendance on the part of the pupils. To this end the committee offered prizes as follows: for the best attendance, three dollars; for the second best, two dollars; and one dollar to each pupil who should attend forty lessons and over.

The result was that 5 attended fifty-nine lessons; 2, fifty-eight; and 13, forty and over. During the session 22 other pupils attended, varying from three to thirty-nine lessons. The age of the pupils ranged from ten to fifteen years.

The first five weeks were almost entirely devoted to teaching the pupils how to handle the tools, and during this preliminary course the stock was all used up, except samples of mortises and tenons. From the 6th to the 19th of August, besides other work, the jaws of the vises were made and fitted for the screws, and also ten bench-drawers; from the 19th to the 23d, boxes with mitre joints and rabbets for bottom; from the 23d to the 30th, halved-together joints, and mortise and tenon joints; to September 3, an open dovetailed joint and a half-dovetailed joint; from the 3d to the 5th, a section of a door with double mortise and tenon and groove for panel; from September 6 to 8, a half-dovetailed joint, halved together at corner; also, sample square and mitre saw cuts, blocked and unblocked. The last week was spent in reviewing, and making a large box with half-blind dovetailed joints. The work was

left so that all parts could be examined, and was all done by the pupils, except the laying out for some of the joints. The quality and not the quantity of the work was kept in view by teacher and pupils, and no attempt was made to do more than teach the simplest elements and manipulations.

At the end of the course many of the pupils were in a condition to begin to apply what they had learned to more difficult forms, and to the making of simple but useful articles. We were also glad to be able to say that, in addition to the work which each pupil had to show, we saw a marked change in his temper and spirit, as well as interest, — so marked as to convince us that this was by no means the least valuable result of the instruction.

Until the time should come to introduce this instruction in our public-school course, we recommended that the vacation school be continued. At the close of the course the school committee, with others, inspected the work, and were satisfied, upon the whole, with the results, which were far in advance of those of previous years.

The school opened again on July 6, 1885, and continued ten weeks. Three classes of 14 each were formed, varying in age from nine to fourteen years, each class having a daily lesson of two hours. During the first four weeks 59 different pupils had been in the school, and no new ones were afterwards admitted. After this the average daily attendance for a time was 12 in each class, and then fell to 9 in the closing weeks. The same system was followed, and the moderate attendance secured was the result of the prizes offered, as in the previous year; but we became satisfied that the method of prizes had not been sufficiently successful to be continued. As soon as the pupil found that he had lost the prize through non-attendance, he lost to a great extent all interest in his work.

We carefully watched this experiment, and felt sure that enough had been done to warrant the conclusion that these boys ought to have at least two lessons of this kind per week throughout the school year, continued as long as they remain in school. We should not expect much success, or much of permanent value, from any other study pursued as this was. We were also satisfied that two shop lessons per week would not interfere with the other studies of the school, and that they ought to be given just as soon as the proper room could be secured. Manual training was a part of the current instruction in between forty and fifty colleges and other schools in the United States, and it seemed certain that in one form or another this training would gradually work its way into our public schools.

Nothing, in our opinion, would more largely promote the best interests of the town than the establishing and supporting of a fully equipped and well-conducted manual training school for boys of the proper age and preparation; thus, by a three or four years' course of judiciously combined mental and manual studies, giving them a sound and broad education, which should both develop special aptitudes and point the way to a probable field of usefulness.

In the near future the town will be called upon to provide new and enlarged school buildings, and this subject, in this connection, should be fully and carefully considered.

During this vacation the instruction was given by Mr. S. C. Griffin, who conducted the work of this department with great success till his resignation in the spring of 1891.

In the vacation school for the summer of 1886 the methods employed were the same as in past years, and by some of the pupils a gratifying proficiency was attained. The attendance was encouraging, and at the close of the term a public exhibition was given, and much interest was shown by those who attended. Some of the work was so skilfully done as to surprise those who were not before aware of what has been accomplished by this school.

In November last (1886), at a meeting of the school committee and the advisory board, the ladies proposed that the school committee should authorize the establishment of a cooking school for girls in the upper classes of the grammar schools, the instruction to be a course of twelve lessons, under the supervision of the advisory board. Attendance on the lessons was to be limited to selected pupils, and was to be obligatory. The necessary equipment was furnished by private subscription, and a course of lessons was begun. The plan proposed three classes of six each, and one lesson a week for twelve weeks. It met with the approval of the board, and was carried out as successfully as could reasonably be expected with the means at hand.

The results thus far accomplished led the advisory board to recommend a vacation school for girls, and their suggestions, contained in a paper presented to the board, were approved, and are as follows: —

The ladies of the advisory board, and a few others, desire to present to the attention of the school committee the importance of opening a vacation school for girls, during the coming summer, to supply the same want which has already been met for the boys. They would suggest that the same sum appropriated for the boys' vacation school ($250) should be allowed for the girls, and that some suitable rooms in one of the school buildings should be assigned for the purpose. They offer

their services to the committee in arranging and supervising such a school, and would hope to organize classes in cooking and sewing.

They are also anxious to express their strong interest in the introduction of industrial training into our Brookline schools, and to present some of the reasons for so doing that seem to them most important and convincing.

The first establishment of our public schools may be regarded as an act of self-defence on the part of the founders of our republic. It was *in no sense* an act of philanthropy. The clearly avowed object was to produce a higher and better citizenship, a more intelligent and self-dependent population. Remembering this, it becomes evident that any modification of the present public school system must be proved to be *educational* in the broadest sense. We are at the bar of the State and the tax payer, and these have a right to demand that we give, in return for their investment, the thing they have bargained for, namely, that which produces a population better fitted to support and govern themselves. Now, this is precisely what we claim for industrial training, as it is now conducted in the classes to which some of the children from the public schools in Boston are sent. Men and women who are made capable of sound reasoning, observant, cautious, self-reliant, are likely to be good citizens themselves, and to be the parents of good citizens. The lessons in making a loaf of bread or a careful mortise are also better lessons in chemistry and physics than most of those found in the text books, and, as now taught, are object lessons, language lessons, drawing and writing lessons as well. Children who are not easily reached through the printed page are often aroused to intelligent interest in abstract ideas which are conveyed to them through manual training.

For these reasons we hope that the school-house to be built on Boylston Street will be so planned and constructed as to allow rooms for industrial training, and that the town will make a sufficient appropriation for that purpose.

The vacation school was continued in the summer of 1887, and the results were in all respects more satisfactory than in any previous year; so much so that the school committee and the comparatively large number who visited the exhibition in the town hall believed that the time had come to introduce manual training into our public schools. The time for this step also seemed opportune in view of the fact that several of the schools of the town were soon to be transferred to new and more commodious buildings, in which it would be possible to conduct the instruction in the revised courses of study.

In the spring of 1888 the Ward School was transferred to the new Wm. H. Lincoln building on Boylston Street; but the new course of studies did not go into operation till the following fall.

The vacation school of 1888 was held in the Wm. H. Lincoln building, and the results were very satisfactory.

During the year 1888–89 a new sub-committee on industrial schools had been formed and put in charge of this department of the school work, and it now only remains to give some account of this new department, as shown in the reports of this committee.

In spite of some repetition, it may be well, as a summary, to include the greater part of the report for 1888–89, showing what the results of the vacation school experiment had been, and the way they had been introduced into the Wm. H. Lincoln School.

In the summer of 1880, in deference to what seemed to be a growing public demand, an industrial vacation school of carpentry for boys was established. This step was taken as an experiment to determine whether boys of the grammar-school age have the physical and mental maturity to profit by such a course of instruction. It was supposed that a certain amount of hand skill in the use of tools could be acquired, but to what extent such pupils could be made to grasp the principles involved in mechanic arts work, and to comprehend the best methods to be followed in the solutions of simple problems, were questions to be answered by the results of the experiment.

The two most serious difficulties encountered at the outset were: to secure some degree of regularity of attendance, where none was obligatory, and the pupils preferred the freedom of the streets and the fields to constraints of the shop; and to find knowledge and experience in teaching combined with ability to interest and control the pupils under such unfavorable conditions. But these obstacles were met, and to a considerable degree overcome. Not only the members of the school committee, but others who took sufficient interest in the experiment to note the gain from year to year, became convinced that the teaching of hand-work as a laboratory exercise and as a means of mental development had been successful, and would be still more so under the more favorable conditions of being adopted by the public school and placed among its requirements as a subject of systematic study and discipline.

In the mean time, classes of girls from the grammar schools had been taught cooking, leading to the establishment of a vacation school for girls, in which sewing and cooking were prominent subjects of study. These experiments also had met with sufficient success to justify, in the opinion of those most interested, the introduction of these subjects into the required course of grammar school studies. Finally the opportunity came in the erection of the Wm. H. Lincoln grammar school building. Besides accommodations for eight classes of pupils, it also contained basement rooms suitable for carpentry and other hand studies for boys,

while rooms well adapted for cooking and sewing were found on the upper floor.

In the spring of 1888, when the pupils of the Ward School were transferred to the new Lincoln building, the committee began to consider the question of the reorganization of the course of study, to take effect at the beginning of the next school year. After full consideration, it was decided to begin by giving to all pupils of twelve years of age and over (which on the average included the upper three of the seven classes then composing the school) six hours of hand studies per week, and to the remaining classes four hours per week, out of the required twenty-five hours per week. The time allotted to each of the several hand studies included in the course was as follows: —

Free-hand drawing, in two one-hour lessons per week, was given to all the pupils of the school (279).

Carpentry, in two two-hour lessons per week for the upper three classes, and in two one-hour lessons per week for the remaining classes, was given to all the boys of the school (144).

Sewing, in two one-hour lessons per week, was given to all the girls of the school (135).

Cooking, in one two-hour lesson per week, was given to all the girls in the upper three classes (56).

During the second half of the year, which began February 11, the carpentry lessons of the first class were reduced to one hour each, and the other was given to mechanical drawing; and a portion of the time which the girls of the first class had given to sewing was devoted to cutting and fitting.

The shop for carpentry was fitted with twenty-four benches and sets of tools, and was large enough to include all the boys in any class of the school in a single section.

The room for cooking was fitted for fifteen in a section, but when necessary a few more were included. The room for sewing was fitted with twenty-four chairs and single tables, and also with larger tables for cutting.

The aim in the hand studies has not been to produce the largest manual results, but to determine the best methods for making this work the most effective as an intellectual discipline. It is proposed to add other hand studies as fast as the best interests of the school shall seem to require.

It may be well briefly to consider the terms *industrial education* and *manual training*, and inquire in what sense they should be used in connection with the hand studies in the Lincoln School. Hand studies in any school, or in any course of study, may be considered and used simply as an educational means, or largely as

an educational end. If considered as an *end*, then the school becomes a special school with a special mission, having in view the preparation of its pupils, through the skill of hand acquired, for immediate entrance upon some industrial pursuit in which hand training finds a ready application. Such a school has a purely *industrial* end in view, and is a special technical school. On the other hand, hand studies may be given very little practical prominence, and be regarded mainly as the best means for cultivating the powers of observation, invention and judgment, and used almost entirely as an *educational* means. It is in this sense that these studies are regarded and used in the Lincoln School.

We do not know what the future has in store for our children, nor is it the business of school boards and teachers to inquire. The only question is, In what way, and by what means, can we best develop the special capacities and aptitudes of each child, moral and intellectual, so that it shall most easily find its proper sphere in life, and become a self-dependent and a self-governed citizen? It is in this spirit, and with these high aims in view, that we are striving to build up our public schools.

The work outlined in the report for 1888–89 for the Lincoln School was continued to the end of the year without change of plan, subjects or hours, when an exhibition was held, which was largely attended by Brookline citizens and friends of the school, as well as by many from the adjoining towns, who had been attracted by reports of what the school was doing, or by their interest in the subject. This exhibition of the work of the school was in all respects successful, and seemed to leave no doubts in the minds of the visitors of the educational value of this work, or of the importance of its extension and full development along the lines so successfully followed during the first year. All the courses in free-hand and mechanical drawing, in carpentry, in cooking and in sewing, were continued and improved during the year 1889–90.

The boys of the upper three classes had practically finished the course in carpentry at the end of the spring term, and at the opening of the school in September began a course in wood carving, with a corresponding course in mechanical drawing, which continued till the room for wood turning and pattern making in the annex to the Wm. H. Lincoln building was fitted for use.

Soon after taking possession of the Lincoln building it became apparent that no great development of these hand courses could there take place for want of proper space. In this contingency the conclusion was quickly reached that a new building, adapted to the extension of this work, and connected with the Lincoln building, must be provided. This has been done, and the courses

in carpentry, in wood carving and in mechanical drawing are already well accommodated on the upper floor of the new annex. There still remained on this floor a room in which it was proposed to place sixteen wood-turning lathes, sixteen benches adapted to pattern making, a grindstone, one circular saw, and one scroll saw. On the lower floor, as fast as the needs of the school required, it was proposed to provide a foundry, a forging shop and a machine tool shop. The annex would then contain the facilities for instruction in all the fundamental arts in wood and metal constructions. When all the rooms in the annex are fully equipped, it will furnish the best of facilities for teaching a much larger number of pupils than can be accommodated in the Lincoln School, and it is hoped that a manual training school * of an advanced grade may be established on the lot adjoining the annex, lately purchased by the town, in order that the educational facilities of the new annex may be fully utilized.

The manual instruction outlined in the report for 1889–90 was continued during the year 1890–91 with increasing interest and success. A most important step was the addition of a wood-turning and pattern shop. This shop is furnished with sixteen lathes and pattern benches, so arranged that the pupil turns from one to the other without leaving his place. The shop also contains one circular saw, one scroll saw and one grindstone, which is so placed that it can be used readily by pupils in carpentry. The power for this shop is furnished by a Thomson-Houston fifteen horse-power electric motor, which has thus far given great satisfaction.

There has been a steady improvement in the amount and quality of the work done in all departments. The teachers have grown in experience and skill, and the pupils have shown an increasing interest and desire to succeed and merit promotion.

Increased attention has been given in the teaching to the methods and details. In the past there has been great difficulty in so co-ordinating the drawing and shop work as to make their mutual relations sufficiently apparent, particularly to the younger pupils. To remedy this defect, and to have the proper drawing always ready for use in the shop, all the drawings of the shop courses have been carefully made, and blue print copies taken, and these blue prints are now used by all the pupils in their work. Even the youngest pupil, by a constant comparison of his work with the drawing which is always before him, learns to understand and use

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* A manual training school building is now (August, 1893) in course of erection on the lot adjoining the annex to the Wm. H. Lincoln School.

it long before he is old enough to be put upon a course of mechanical drawing.

It is also becoming more apparent that the simple manipulations, or work of the hand, constitute but a small part of the educational value of industrial work. If the pupil solves a problem in arithmetic by rule, no matter how expert he may be in the numerical processes, it is plain that the great value of the study as an educational factor is lost unless at the same time he is made to see the reasons and proofs upon which the rule is based. So in mechanical problems, and, indeed, in all processes in which the hand is an instrument, the method of solution, and why one method is better than another, becomes a most important matter. Nor is this all. The pupil should be taught to judge of the quality of his own work, as of that of others, by some systematic and well-defined method of inspection. Of the three steps, — the method of solution, the execution of the method and the estimate of the quality of the work done, — it is not difficult to see that the first and third are too important to be overlooked in any well-defined system of industrial instruction.

The last exhibition of work in all departments gave great satisfaction to all the friends of the school, as well as to many others who were drawn to the exhibition by their interest in this new departure of grammar-school work.

Appendix C.

MANUAL TRAINING IN THE WILLIAM H. LINCOLN SCHOOL, BROOKLINE, MASS.

Remarks by Principal D. S. FARNHAM.

The manual training element in our school is the outgrowth of vacation schools, which were started some eight years ago. The first was a school in carpentry, for such pupils as had nothing special with which to employ their time during the summer. This school was supported entirely by town appropriation, and continued through the summer vacation, taking only those boys whose parents or guardian would sign an agreement that the boy should attend regularly, unless detained by reason of sickness. The numbers, I think, ranged from 18 to 25. Prizes were given for excellent work, good deportment and regular attendance. These boys came largely from my district.

At the beginning of the school year, in September, the various grades of work done by this vacation school were on exhibition at the town hall, and the town's people were asked to visit the exhibit, and inspect the work. These exhibitions excited much interest. I always interested myself, at the opening of the school year, in the work of the boys during their vacation, never failing to ask each one what he had learned and what he had made at the carpentry school. Thus this work went on till we felt that it was almost a part of our own work.

Some six years ago — or about two years before we came to the new building — the benevolent ladies in Brookline started a cooking school for such girls as could attend during the summer vacation. The work was successful, and at the opening of my school, in September, these good ladies proposed that the girls in my seventh and eighth grades stay away from my school one day in the week for a two-hours lesson in cooking in this private cooking school, carried on by benevolence. This was not received with

favor by all connected with public instruction in Brookline. It was finally referred to me, and, strange to say, I very much favored the project, saying the girls would get more good from that school than they possibly could from mine in the same time. Thus did the cooking school become virtually a part of my school, although I was never inside the room of the cooking school. At every lesson given by the cooking teacher a record of attendance was kept, as well as of conduct, and reported to me. If a girl were absent or tardy at the cooking lesson, she was marked on my register as though she had been absent or tardy in my room.

Thus these two outside schools went on — the carpentry for some four years and the cooking about two years — before our new building was erected; so that when we dedicated it, May, 1887, we had quite a little manual training element in our hands. Sewing had been taught in some of the grades for many years previous to this. In September following our dedication of the Wm. H. Lincoln School, rooms were fitted up for carpentry, cooking and sewing, a permanent teacher being employed for each department. Mr. S. C. Griffin, the teacher of the vacation carpentry school from 1885, was employed to take charge of the shop work, and the other teachers were secured for the cooking and sewing departments.

At the close of our first school year, with this manual element introduced as a part of our regular school exercises in the building, we held an exhibition in our hall, showing specimens of every kind of work done in our building, I think, except reading. This exhibition attracted very much attention, not only in Brookline but in surrounding towns. The cooking and sewing teachers each had a good room, but the boys had nothing but the basement for a shop. The boys' work was greatly commended, and our worthy chairman, Mr. William H. Lincoln, was so much pleased with the quality of the boys' work that he then and there offered to give $3,000 towards building a shop to be annexed to my building, provided the town of Brookline would appropriate $3,000 more. A town meeting was at once called, the necessary appropriation made, and when I returned in September the building was nearly finished, containing six nice rooms. In this building we have a mechanical drawing room, which accommodates twenty-four boys; a carpentry shop, with twenty-six benches which are also used for wood carving; a wood-turning room, with sixteen lathes and sixteen pattern-making benches, — though we have not as yet done anything at pattern making, but expect to do something this term. In the lower part of the building we have three rooms which are intended for forging, foundry work and metal turning. The shop

work, cooking, sewing and free-hand drawing have as their share of the school term six hours per week. The above subjects are known with us as the manual training department.

In our sewing room a girl learns to do all kinds of sewing which she will have any occasion to use in after life; and we feel it is being taught in a scientific manner by Miss Johnson. For instance, before the girl sews on a patch or makes a darn, she is required to make a drawing, on paper or the black-board, of what is to be done, and, after the needle-work is done, to write out a description of it. All girls before graduation learn to cut and fit a dress. This dress-fitting is done in the ninth year. The room seats twenty-four girls.

In our cooking room the girls learn to compound materials for food, but this is only a part of the work. Our teacher in this department, Miss Willey, is said to be a most excellent chemist, and the girls have the chemical analysis of food plants, eggs, beef, milk, etc. This kind of work leads a grammar-school girl to take quite a different view of life from that suggested by the old method of school work. The cooking teacher can teach from twenty to twenty-four girls at a time, — though this is rather more than is profitable, I think. We have gas for light cooking, and a large cook-stove for other work. Both the sewing and the cooking rooms are on the third floor, and were fitted up for these purposes after the building was finished. They serve a very excellent purpose.

In all shop work there is a carefully planned graded system of work. All work to be done in wood is first drawn on paper, in the mechanical drawing room, and then blue-printed by the boys. The blue print is before the boy in all wood work, and everything is worked to a scale, which greatly "sharpens the wits" of the boy. If your Commission has any doubt on this point, come and observe when a convenient opportunity offers.

I am a firm believer in educating the eye, hand and mind together. I have in past years myself received great profit from this kind of education. It is the kind I want my own boy to have. I am deeply interested in the poorest boy in our Commonwealth; whether I ever see him or not, I feel for his highest good. When I came to Brookline, I think I had the poorest apology for a school that could at that time be found in the State of Massachusetts. It was known all about this part of the land as being the "toughest school to be found." It has been uplifted by these various agencies, till to-day I am proud of it, and I know of no school in which I would so soon have my child as in this Wm. H. Lincoln School.

You ask me whether manual training has done all this. I say no, heart training has gone hand in hand with it; we never separate them.

I am very clear in my convictions that the various agencies called manual training have opened our pupils' eyes and minds as no other kind of work could, and my teachers feel the same way in this matter. When a girl comprehends the chemical analysis of food, and learns to properly compound materials, I feel her mental activity is aroused and strengthened. When a boy becomes master of a chisel working into a piece of wood which is revolving three hundred times a minute, and cuts that piece of wood to a certain scale-size, we feel he has acquired a power which will help him everywhere in life. The same is true in using carving and all other kinds of tools. The teachers in my school observe the great value of this work as an educational power, and speak of it to me. I attribute our success largely to the vacation schools, which in a measure prepared the way, and the fervent interest the teachers have put into the work since it came to my building. There is no divided opinion about this among my teachers. We also unite in heartfelt support of it, and carrying it out to the best of our ability. I question whether all towns and cities could do just the kind of work that we are doing with a miscellaneous class of teachers without a guiding spirit.

The extra cost at present to the town for a girl's instruction in cooking is $3.60 per year; for the sewing, $3.46; for a boy in the shop and all that pertains to it, not far from $6.00 a year. The upper four classes of girls get two hours a week in the cooking room at one lesson and two hours a week in the sewing room at one lesson. The girls below these do not cook, but have two lessons of one hour each in the sewing room; while the boys in these upper classes get two lessons of one hour each in the mechanical drawing room and two lessons of one hour each either at wood carving or wood turning, according to the grade. The two higher classes take wood turning. The boys in the lowest grades have two lessons of one hour each in the carpentry shop.

I feel that our pupils do not suffer any great loss in the other subjects by taking the six hours for these subjects, for, now that we have less time, we have to apply ourselves more closely and surely to what is valuable and practical. The rubbish has been thrown overboard, and all my teachers rejoice in it.

MARCH, 1892.

Appendix D.

A STATEMENT CONCERNING MANUAL TRAINING IN THE SCHOOLS OF BROOKLINE.

By S. T. DUTTON, Superintendent of Schools.

To the Commission.

I understand that Professor Runkle has given you full information in regard to the plan and scope of manual training in the Lincoln School. He has undoubtedly explained what the purpose of the school committee is with respect to extending this work gradually to the other grammar schools of the town, and has told you that we hope at no distant day to have a manual training school of high-school grade, so located that the shops in the Lincoln School can be utilized for that purpose. I need not enlarge upon the points which he has covered. I will make some statement concerning the relation of this work to other departments of teaching, and indicate what has been accomplished in other lines of concrete instruction.

During the past two years kindergartens have been introduced into five primary schools, so that there are now seven kindergartens in the town. These are the true foundation, not only of all manual training, but of intellectual training. The effect upon the children of kindergarten instruction as they pass into the higher grades is very noticeable and very much appreciated by our teachers. Instruction in needle-work is now begun in the third year and carried through to the high school. Between the kindergarten and the time when needle-work begins we have exercises in clay modelling, building, stick laying, cutting, weaving, etc., which seem to supply sufficient manual training. There is a gap in the third and fourth years as far as the boys are concerned, and we are now considering whether the Swedish sloyd may not be attempted to fill that gap. The general principle upon which we are working is that manual training belongs to every grade, from the kindergarten through the high school; and we are not in sympathy

with the idea that the manual training equipment is to be provided merely for pupils of high grade.

In answer to your question whether the girls could not have instruction in the use of tools as well as in sewing and cooking, I will say that, if it were found that time could properly be spared for such exercises, in addition to those in sewing and cooking, I should like to give all the girls some experience in the shop. This is a question that has not yet been considered in Brookline. It has been thought enough thus far to give the girls their own instruction in sewing and cooking, and let the boys have the tool work. When we have a new high-school building, as we hope to have within a few years, it is likely that in connection with the laboratories some shop work will be provided.

Kindred to manual exercises to which I have alluded is that instruction which brings the children into contact with nature and the forces of nature. A course of instruction has been begun during the past year that will give the children in the primary and grammar schools a general view of the facts of nature. This work is pursued entirely by observation and experiment. Pupils make drawings and write descriptions of every experiment. This form of instruction, in connection with manual training, reveals to the teachers the value of concrete ideas as means of stimulating thought and expression. The tone of the schools is greatly improved.

Educational reform to-day consists in bringing the elements down to the beginning of the child's school life, so that the germs of all subjects are planted in his early school experience and grow up with him. The old idea of education was something like an inverted cone with the base at the top; the modern idea is to turn over this cone and set it squarely on its foundation, so that, as in the kindergarten, the beginning of the child's education may be broad, and specialization come later in life.

MARCH, 1892.

Appendix E.

MANUAL TRAINING IN THE STATE NORMAL SCHOOL AT BRIDGEWATER.

By Principal A. G. BOYDEN.

State Normal School, Bridgewater, Mass., April, 1893.

To the Commission on Manual Training and Industrial Education.

In answer to your inquiry concerning the course in manual training in this school and the benefits derived from it, I would say that we have had an industrial laboratory for wood-working in operation for the last twelve years. All our students, both men and women, take a course of two hours a week for the term of twenty weeks, with the privilege of such additional work in the laboratory as they may desire. One of the regular instructors of the school is the teacher in this department.

The aim and quality of this work are shown in the outline of the course, which follows: —

Wood-working.

Introduction.

Manual training in its recent and technical sense is strictly educative in its aim. It is thoughtful use of the hands in finding the qualities of bodies, in manipulating apparatus in the study of the physical forces, and in the expression of ideas by drawing and constructing.

The following principles determine the selection and arrangement of this course in wood-working: —

1. The workshop, tools and work should be such as to impress the pupil with the meaning and value of skilled manual labor.
2. The objects constructed should be of practical value, and be the property of the pupil.
3. The objects should be constructed from working drawings made by the pupil from the model or by invention.
4. The objects should be typical in respect to material, operations and purpose, and should be graded according to difficulty in making them.

The Materials of Construction.

Wood.

Structure. — Examine the squared end of a tree stem (oak). Observe the position, amount, hardness, color and other prominent qualities of the outer and inner *bark*, *cambium*, *sapwood*, *heartwood* and *pith* (medulla). Draw the end section. Observe the *annual lines* and rings and the *medullary rays.* Count the rings to find the age of tree. Observe the cracks in the ends of logs. Break a small ash stick and observe the splintery fracture. Of what is wood largely composed?

Composition. — Heat strongly in different closed tubes (chemistry) portions of the heartwood and sapwood of a living tree. Observe what collects on the upper part of the tubes, and the difference in amount. What remains in the tubes?

Seasoning. — Observe cracks in boards and in ends of logs, the spaces between boards in floor or sheathing. What difference is there between *side* spaces and *end* spaces? What are the effects of seasoning upon the dimensions of lumber? Observe boards that have curled or twisted in drying. What relation do you find between the kind and amount of warping and the part of the log from which the board came? How straighten a warped board? Which side of a board should be put "to the weather" in construction?

Grain. — (The character and direction of the fibres, or the appearance of a finished surface.) Examine straight-grained and cross-grained woods, fine and coarse grained woods (boxwood and oak), even and uneven grained woods (pine and ash).

Examine *sections* (1) parallel to the medullary rays (edge or quarter grain), (2) tangential to the annual rings (side grain), (3) perpendicular to the fibres (end grain). Explain cutting *with* and *against* the grain. What is veneer? silver grain? curly grain? bird's-eye grain? What causes the lines between the annual rings?

Strength. — Illustration: oak bends with difficulty and is stiff, chestnut is flexible and elastic, white-wood is very brittle, hickory is tough. Apply these terms to other kinds of wood.

Defects. — Examine and draw *shake*, loose and fast *knots*, *decay*, *wane.* Describe and account for these defects. How preserve wood from decay?

Measure and Value. — Find the number of board feet in assigned pieces of lumber, and the market prices of the common useful woods.

Applications. — Examine and describe the common useful woods, according to the following plan: —

	Hardness.	Weight.	Grain.	Strength.	Ease of Splitting.	Other Qualities.
White pine, .						
Spruce, . .						
Hemlock, . .						
White oak, .						
Yellow birch, .						
Rock maple, .						
Bass wood, .						
White-wood, .						
Hickory, . .						

Fastenings.

Nails. — Examine *cut*, *wrought* and *wire* nails. Observe the shape, parts and how the size is indicated, and the difference between common and finish nails.

Tacks. — Find how the size is indicated.

Screws. — Examine round-head and flat-head screws, blued and bright. Find how the size is indicated.

Make a collection of nails, tacks and screws. Arrange them in an orderly way on strips of board.

Glue. — Learn how to use it. What is sizing?

Pins, *Wedges and Dowels.* — Observe the shape of each.

The Tools, and how to use Them.

Keep bench, closets and tool drawer clean, and the tools in their places when not in use. Do not cut the bench or horses. Do not allow edge tools to be dulled by striking against metallic objects. Use the tools only for the purpose for which they were intended. Protect polished surfaces of steel tools from moisture. Oil will prevent rust if applied occasionally. If a tool should rust, brighten it with emery cloth and oil.

The Bench. — The bench should be of a convenient height (28″ for boys, 32″ for adults), should be rigid, and have a hard-wood plank top. The top should be perfectly flat and smooth. The *bench vise* is used for holding the work for planing or boring; the jaw should be kept parallel to front of bench. It is adjusted by the screw and a strip of board at the bottom. Do not pinch the work so as to indent it. The *horses* are used for holding large pieces of board while being sawed. They should be 20″ high. One or two *hand screws* for clamping pieces of work together or to the bench will be found useful.

Measuring and Lining Tools: —

Rule. — Usually made of boxwood, brass faced. It is graduated into inches and fractions of an inch, and is made in parts which fold together. It is named two-fold, four-fold, etc., according to the number of joints. In marking off lengths, place the rule with its edge on the board. Why? Mark the points thus, V, — the vertex of the angle being the desired point. It can be used in lining for distances six inches or less; for greater lengths, use a ruler or straight-edge.

Try-square. — Parts: beam or handle and blade. The beam is often made of hard wood, brass faced, and the blade should be of the best steel. The blade is graduated. A seven-inch blade is a convenient size. In using the try-square to erect perpendiculars, hold the beam firmly against the straight edge of board and draw the line along the outside edge of the blade. When near the end of a board, do not have the beam extending beyond the end, — turn it around.

Marking Gauge. — Parts: beam, head, spur. This tool is used to draw lines parallel to the edges of a board. Set the head at the desired distance from the spur. Draw it along the working edge, pressing against

it slightly, and tipping the beam forward in the direction in which it is moving, so that the spur will not cut too deep.

Dividers or Compasses. — Parts: two legs, arc, set screw, thumb nut. Used in scribing and in laying off arcs or circles. It is also useful in stepping off distances on a line and in transferring measurements from a drawing to the work. Show how to scribe a board to an uneven surface, and a chair, with legs of unequal length, to the floor.

A *pencil* of medium hardness is indispensable for lining on wood.

A *bevel* for drawing oblique angles, and a *scriber* for making fine lines, will be of occasional use.

SAWS: —

Facts common to all hand saws. Parts: handle, blade, teeth. Size told by length of blade in inches and number of teeth to the inch, e. g., "7-teeth" or "7 pts." means that there are seven teeth in every linear inch of blade. The back of saw blade is thinner than the teeth. Why? The teeth are *set* by bending them alternately outward. Why?

Cross-cut saw, twenty-inch blade and ten teeth to inch, is best for ordinary bench work. Examine the teeth (draw side and front views), to find adaptation to use in sawing boards across the grain. In using this saw, hold it lightly in the right hand, with the forefinger extended along the outside. Put the board on the front ends of two horses, the part to be sawed off to the right, and the line to be sawed very near the edge of horse. Hold the board firmly in place with left hand (and left knee if necessary). Begin the kerf by drawing the saw backwards with considerable pressure. Place thumb of left hand against the blade to steady it in starting. Proceed with the sawing, using *no pressure*, with long strokes. Follow the line. Test perpendicularity of saw blade to board until practice gives a correct habit. To guide the saw, watch closely its path by looking vertically down upon it. If the saw leave the line twist the blade while it is moving in the kerf.

Rip saw, twenty-four-inch blade, six teeth. Examine and draw the teeth, — side and end views. Compare them with teeth of cross-cut saw. Why are the teeth of this shape for sawing along the grain? Hold this saw and the board as above, except that the end of line to be sawed should be to the left, and the right knee is used. When you need to saw both along and across the grain on the same piece of work, always use the rip saw first.

Back saw, twelve-inch blade. This saw is used for light work, — with the bench hook for cross-cut sawing, and with the bench vise for rip sawing (dovetail saw).

One or two *compass saws* should be provided for general use. They are used in sawing on curved lines.

CUTTING TOOLS: —

Firmer Chisel. — A paring chisel. Parts: handle (ferule or ring), blade, — shank or socket, face, bevel, cutting edge. Draw the chisel, and place the names of parts on the drawing. The size is told by width of blade at cutting edge. Each pupil should have a three-eighth-inch

and a five-eighth-inch chisel, and an assorted set should be provided for general use. Show how to use the chisel in scoring and paring, chamfering and mortising.

Jack Plane. — Parts: wedge or chip; plane iron, — cutting iron, cap or break iron, connecting screw; stock, — toe, heel, sole, throat, mouth, bed, handle (lever or thumb screw, horn). Learn how to adjust the plane iron.

To use the jack plane: Put the board in the bench vise, the part to be planed parallel to top of bench and about one-half inch above it, for planing edges. Put the board on top of bench against the stop for planing broad sides. Stand with right side of body at bench behind rear end of board to be planed, left foot advanced in a bracing attitude, and so that the body may move freely lengthwise of bench; handle of plane in right hand loosely, with forefinger extended to the plane iron; left hand on the toe of the plane. Place sole of plane on the board with plane iron just back of the rear end. Press down hard with left hand. Push firmly and steadily with right. When near the forward end let go with left hand. Always keep the sole parallel to the surface to be formed. Test the work with try-square and straight-edge. Show how to make a *chamfer* with the plane.

A *smoothing plane*, a *jointer* and a *block plane* should be provided for occasional use. Planes should have their soles oiled frequently. When not in use always keep them lying on their side or else raise the plane iron.

Auger-bit. — Parts: spur, two nibs or cutters, two lips or knives, twist, shank, tang. The size is the distance between extremities of nibs. Each pupil should have a three-fourth-inch, a half-inch and a quarter-inch bit, and a complete set should be provided for general use. The bit is held and rotated by the *bit stock* (or bit brace), the parts of which are the jaw (or socket), shank, handle and button. Put the tang of bit into jaw of bit stock and tighten the thumb screw. Put the work in the bench vise so that the point to be bored is at a convenient height above top of bench. If there is danger of splitting, make a hole with the brad awl first. Take button of stock in left hand, handle in right. Put the spur of bit upon the proper point. Test perpendicularity with the testing block. Stand upright and squarely in front of the work. Rotate to the right. Bore until the spur shows through, then turn the work and finish from the other side.

Jack-knife. — Strong, one blade. Learn how to hold it properly. In cutting do not have the free hand in front of the blade. This applies also to the chisel.

Miscellaneous Tools and Appliances: —

Claw Hammer. — Handle; head, — face, eye, claw. Hold the hammer loosely in right hand near the end of the handle Strike square blows. Place the nail so that it will not split the wood. Learn how to drive nails vertically, horizontally, to *toe* nails, to *blind* nails, to withdraw nails.

Nail Set. — Used for setting nails below the surface. Fill the hole with putty.

Screw Driver. — Handle, ferule, blade. One with about five-inch blade and a small one with two-inch blade will do for all ordinary work.

Oilstone. — The best comes from the novaculite quarries, Arkansas. Learn how to sharpen the jack-knife, chisel and plane iron.

Oil Can. — Small, brass. Use sperm oil. Wipe the oilstone after using it.

Dust Brush. — Use it at the close of each exercise.

Sand-paper Block. — Two inches by three, cork glued on one side. In using sand-paper the motion should be *along* the grain, to avoid scratching. Use whiting with the sand-paper when you wish to finish in the natural grain. The sand-paper should not be made to do the work of the plane, chisel or saw.

The following should be provided for *general* use: pincers, pliers, snip shears, mitre boxes with back saws, anvil vise, chopping block and hand axe, cold chisels, framing chisels and mallets, brad awls, countersink bits, half-round files, grindstone, large steel square, turning lathe with circular saw and jig-saw attachment, sand-paper, liquid glue, paint and paint brushes, shellac and shellac brushes, stain and stain brushes, putty and putty knife.

Construction.

The *order of work* in making the objects is as follows: —

1. Study of the model, — later, the invention of idea of thing to be made.
2. Accurate working drawing.
3. Study of the materials and tools to be used in reproducing the object.
4. Construction at the bench from the drawing.

I. To make a Ruler. — Use dressed pine $\frac{3}{8}''$ thick. 1. Plane one edge of board straight and square (working face). 2. Mark out (rule and try-square) a piece 26″ long and $2\frac{1}{8}''$ wide. 3. Saw the piece out, — lengthwise first. 4. Plane the sawed face till the board is of the required width (2″). 5. Draw a straight line on each of two adjacent long faces, parallel to the edge and $\frac{3}{16}''$ from it. 6. Chamfer this edge with jack plane to the lines. 7. Mark and saw off both ends with back saw so that the ruler will be 24″ long. 8. Sand-paper the ends and the wide faces. 9. Print the number and your name neatly across one end, and hand in for inspection.

II. Block for Soils. — Use dressed hemlock $\frac{7}{8}''$ thick. 1. As before. 2. Mark and saw out a piece 12″ long, $3\frac{7}{8}''$ wide. 3. Plane it to $3\frac{3}{4}''$ wide. 4. Draw three parallel lines lengthwise on the *heart* side, — one equally distant from the sides, and one on each side of this, one inch between. 5. Draw ten parallel cross lines one inch apart, beginning one inch from one end. 7. At the intersections bore $\frac{3}{4}''$ holes perpendicular to surface. 6. Plane the heart side a little to remove pencil marks. 7. Saw off the ends so that the board will be $11\frac{1}{2}''$ long (back saw). 8. Chamfer this side $\frac{1}{8}''$ with plane on the four edges. 9. Tack a piece of card-board over the reverse side. 10. Sand-paper, number and name.

III. Insect Boards. — Use $\frac{3}{8}''$ and $\frac{1}{2}''$ western pine. 1. Mark and saw out two pieces 21″ long, $2\frac{5}{8}''$ tapering to $1\frac{5}{8}''$ wide and $\frac{3}{8}''$ thick; and one piece 10″ long, $1\frac{1}{8}''$ wide and $\frac{1}{2}''$ thick. 2. Plane the pieces to the required widths. 3. Place the two large pieces wide ends together, $\frac{1}{2}''$ between them; narrow ends $\frac{1}{4}''$ between. 4. Saw the cleats from the 10″ piece (back saw), and nail them across the wide pieces perpendicular to the axis and $17\frac{1}{2}''$ apart. 5. Tack sheet cork over opening between cleats ($2\frac{1}{2}$ oz. tacks). 6. Saw off the ends parallel to cleats to required length. 7. Sand-paper the ends, and edges of top and cleats. 8. Finish in light-brown paint. Use turpentine to dilute the paint if necessary. (Apply two coats of paint, allowing the first to dry, and then sand-papering lightly before applying the second coat.)

IV. Test-tube Holder. — Use $\frac{7}{8}''$ white-wood. 1. Mark and saw out a piece 12″ long, $1\frac{1}{16}''$ wide and $\frac{7}{8}''$ thick. 2. Plane to right width. 3. Bore the hole, allowing for one inch to be sawed off later. 4. Saw lengthwise through the hole. 5. Saw off both ends with back saw. 6. Saw half-way through at end of middle kerf. 7. Chamfer the four corners of handle with firmer chisel. 8. Put on the hinge (narrow, wrought, brass butt). 9. Finish in white shellac. (Apply two or three coats, allowing each to dry before the next is added and sand-papering lightly before each coat is added. Dilute shellac with alcohol, and keep the brushes in a covered cup of alcohol.)

V. Test-tube Stand. — Use $\frac{1}{2}''$ and $\frac{3}{8}''$ western pine. 1. Mark and saw out the base, 10″ long, $3\frac{1}{8}''$ wide and $\frac{1}{2}''$ thick, the uprights $2\frac{1}{2}''$ long, $1\frac{1}{2}''$ wide and $\frac{3}{8}''$ thick, the top 9″ long, $1\frac{3}{4}''$ wide and $\frac{3}{8}''$ thick. 2. Plane and chamfer the base and top according to the drawing. 3. Bore the top and base. 4. Nail the base to the uprights, then the top (No. 18, $1\frac{1}{2}''$ steel wire brads). 5. Glue in the pins (meat skewers). 6. Finish in cherry stain. (Thin the stain with turpentine. One coat is enough.)

VI. Botany Press. — Use $\frac{3}{4}''$ eastern pine. 1. Saw out the pieces to the required sizes at once. 2. Place the boards together, heart sides *out*, and bore the holes for slots. 3. Chamfer the heart side of each board with chisel. 4. Cut out the slots with jack-knife (make an opening with saw first). 5. Bore holes in cleats and fasten them to boards, — hammer, screw driver, 14 $1\frac{1}{2}''$ round-head screws. 6. Get wooden hand screws, remove end screw, bevel the ends to correspond, attach them to the press. 7. Finish in cherry stain and shellac, — one coat of stain, dry, sand-paper, two coats shellac.

VII. Box for Insect Collections. — Use $\frac{1}{4}''$ and $\frac{3}{16}''$ eastern pine. 1. Saw out from $\frac{1}{4}''$ stock two pieces 18″ long and $2\frac{1}{16}''$ wide, two pieces 12′ by $2\frac{1}{16}''$. 2. Plane. 3. Cut grooves for cover on the circular saw. 4. Saw off ends at angle of 45° in mitre box so that the lengths on *inside* will be $16\frac{1}{4}''$ and $10\frac{1}{4}''$ for sides and ends respectively. 5. Glue and nail the ends and sides together properly. 6. Saw out the bottom ($\frac{3}{16}''$ stock), and nail it on. 7. Finish inside with white paint and outside with brown paint. 8. Cut circular pieces of sheet cork and glue them into the bottom in straight rows. 9. Use a pane of glass, 10″ x 16″, for cover.

VIII. Mineral Cabinet.—Use $\frac{7}{8}''$ and $\frac{3}{8}''$ white-wood. 1. Saw out the sides and ends. 2. Plane them to the right widths. 3. Saw and plane the pieces for the door. 4. Rebate the frame for the bottom on circular saw. 5. Saw grooves in door for glass. 6. Mitre the frame and door together. 7. Saw out the bottom and nail it to frame. 8. Saw out the shelves and fasten them in place. 9. Put hinges and hook on the door. 10. Paint inside white and stain the outside.

IX. Specific Gravity Apparatus.—Use $\frac{7}{8}''$ white-wood. 1. Saw out the base and upright and plane them according to the drawing. 2. Chamfer the heart side of base with chisel. 3. Bore the hole near one *end* of base, and fit the upright to it by means of a dowel joint. 4. Graduate the upright. 5. Cut off a piece of No. 12 brass wire 11$''$ long, and bend it properly. 6. Fit this spring to top of upright by means of brad awl and wedge. 7. Cut out two pieces of sheet lead $1\frac{1}{8}''$ square, make a small hole in each corner with knife or brad awl, mould the pans on the block, tie in the strings, drive a $\frac{7}{8}''$ flat head brad through the middle of one pan and bend it for a hook. 8. Adjust the coiled brass spring. 9. Finish in orange shellac.

X. Parallel Force Apparatus.—Western pine. Follow the same order as in the last model. See that the leads are exactly of the same weight, and that the beam balances before the leads are attached.

Additional Apparatus, such as butterfly net, shelves, brackets, physiological apparatus, models for drawing, may be made as time permits.

It will be noticed that the pupil starts with a distinct idea of something which he needs for his own use, and is stimulated in his work by the desire to supply this need. He learns the nature of the materials which he uses, and how to use tools, so that he is able to go on and make for himself other apparatus as he may desire.

The benefits of this training are noticeable in all the lines of school work. Students have better command of themselves in any work which requires the use of the hands, and consequently greater interest in their work. It induces accuracy and skill. At the start the pupil often thinks that an eighth of an inch will make no difference in making a joint. He soon finds that accurate thinking and careful execution are indispensable to finished work,—that he must think before he acts. It gives the pupil the consciousness of power to help himself in manual operations. It stimulates observation of manual work, of drawing and architecture, and deepens the pupil's interest in these things. It begets respect for skilled manual labor and sympathy for the laborer.

Respectfully submitted,

ALBERT G. BOYDEN,
Principal.

Appendix F.

The wood-working now experimentally carried on in the grammar schools of Boston is represented in the following plates.

Plates I., II., III. and IV. show a graded course in wood-work from the Russian shop work, prepared by Mr. Frank M. Leavitt and taught by him in the Eliot School at Jamaica Plain. The room with benches and tools is shown in Plate V.

Plates VI. and VII. show Swedish sloyd for grammar schools, as taught by Mr. Gustaf Larsson, Appleton Street School, Boston.

Plates VIII., IX. and X. show the course taught by Mr. B. F. Eddy at the Industrial School in North Bennet Street, Boston. The class is shown at work in Plate XI., at drawing in Plate XII., and gathered for a demonstration in Plate XIII.

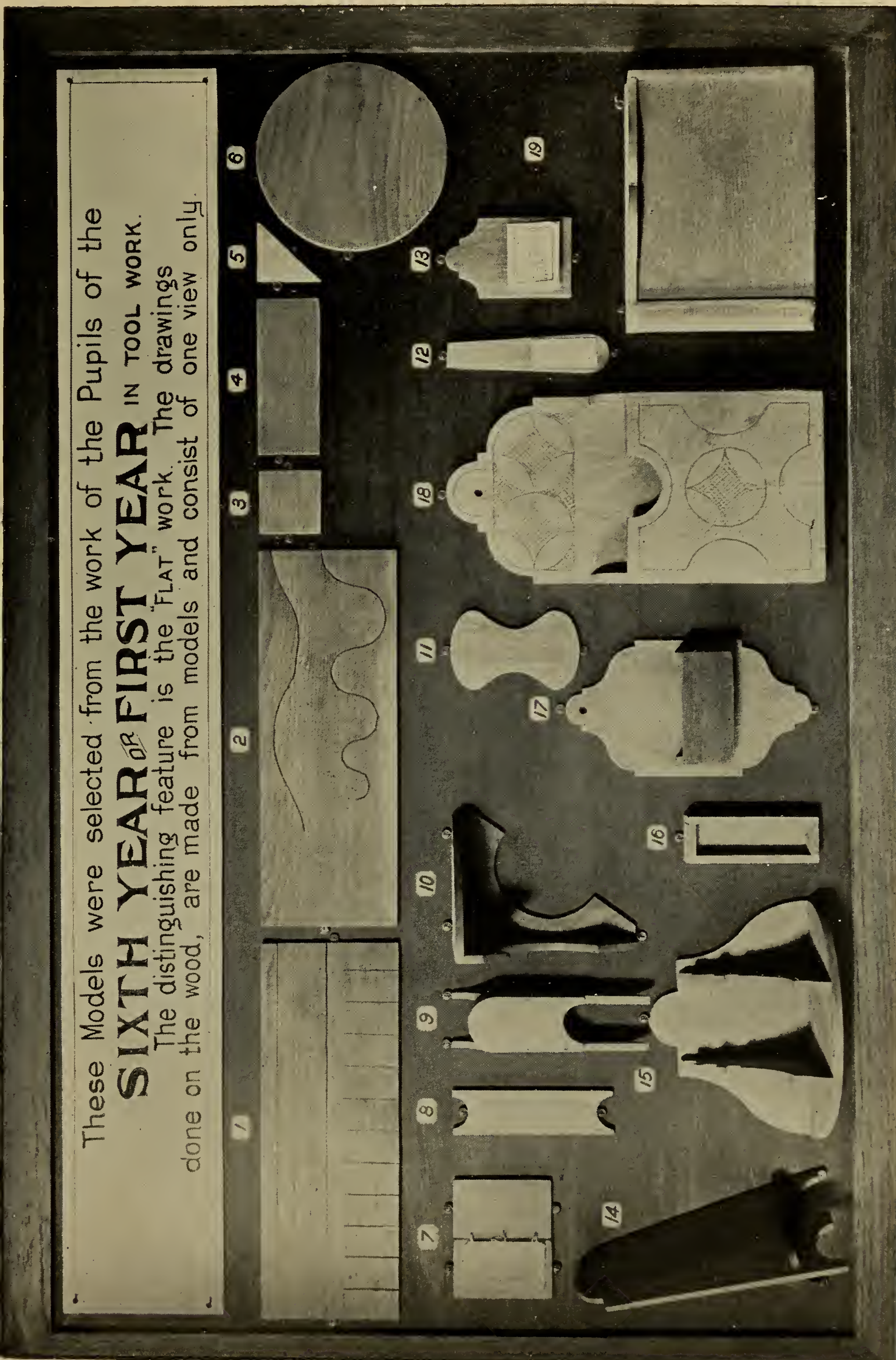
These Models were selected from the work of the Pupils of the
SIXTH YEAR OR FIRST YEAR IN TOOL WORK.
The distinguishing feature is the "FLAT" work. The drawings
done on the wood, are made from models and consist of one view only.

Plate I.

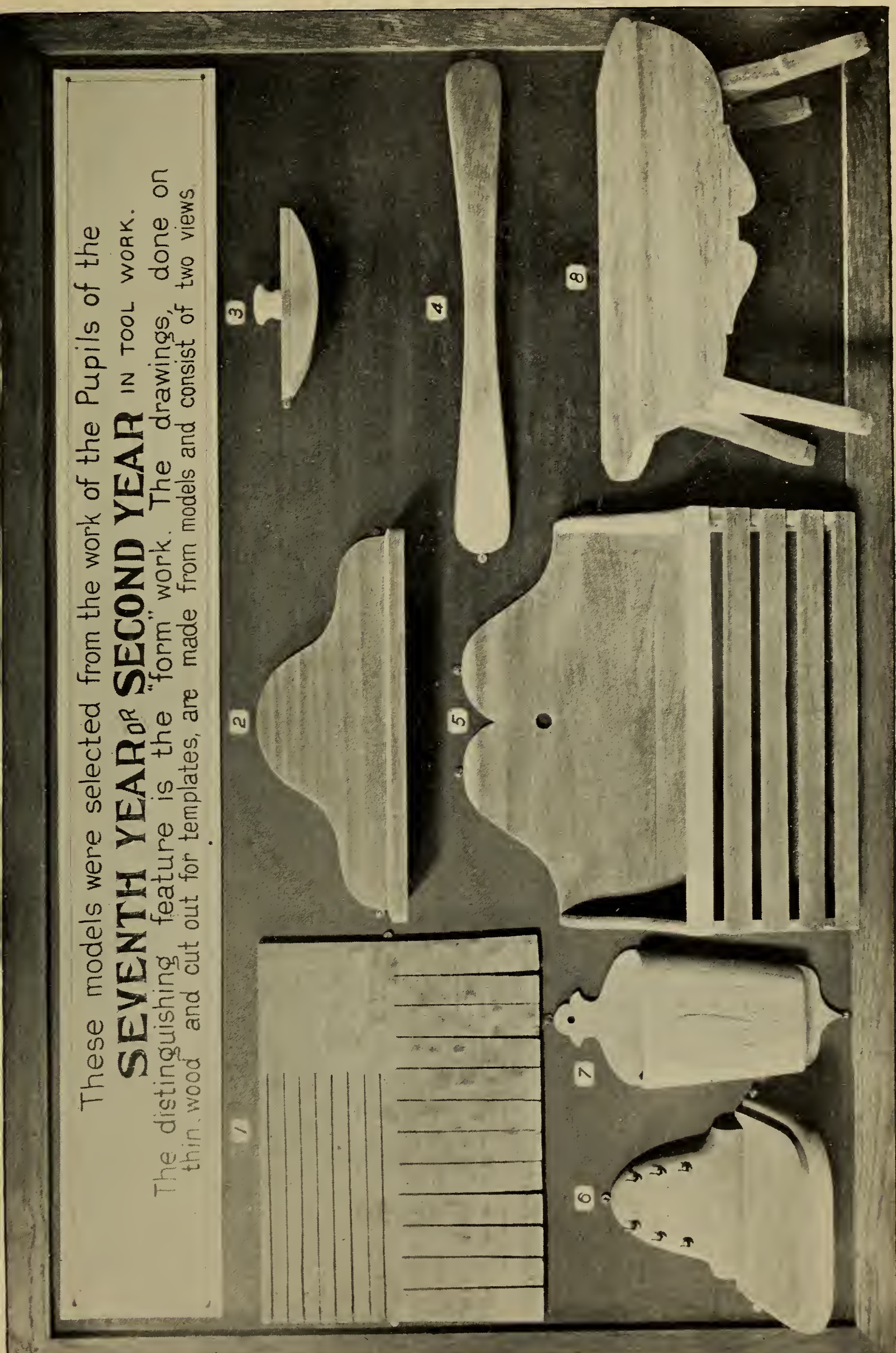
These models were selected from the work of the Pupils of the
SEVENTH YEAR OR SECOND YEAR IN TOOL WORK.
The distinguishing feature is the "form" work. The drawings, done on thin wood and cut out for templates, are made from models and consist of two views.
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Plate II.

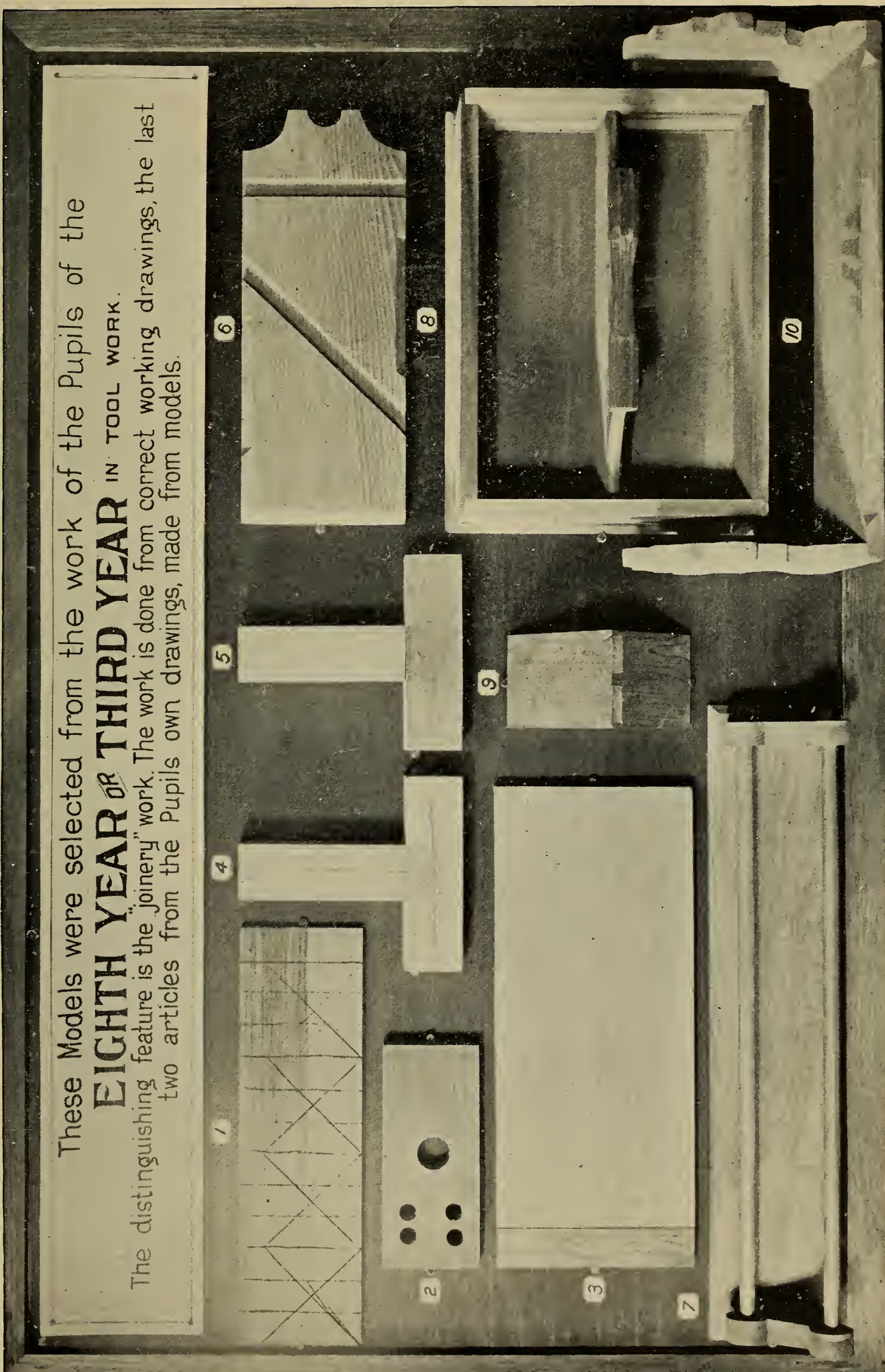
These Models were selected from the work of the Pupils of the
EIGHTH YEAR OR THIRD YEAR IN TOOL WORK.
The distinguishing feature is the "joinery" work. The work is done from correct working drawings, the last two articles from the Pupils own drawings, made from models.

Plate III.

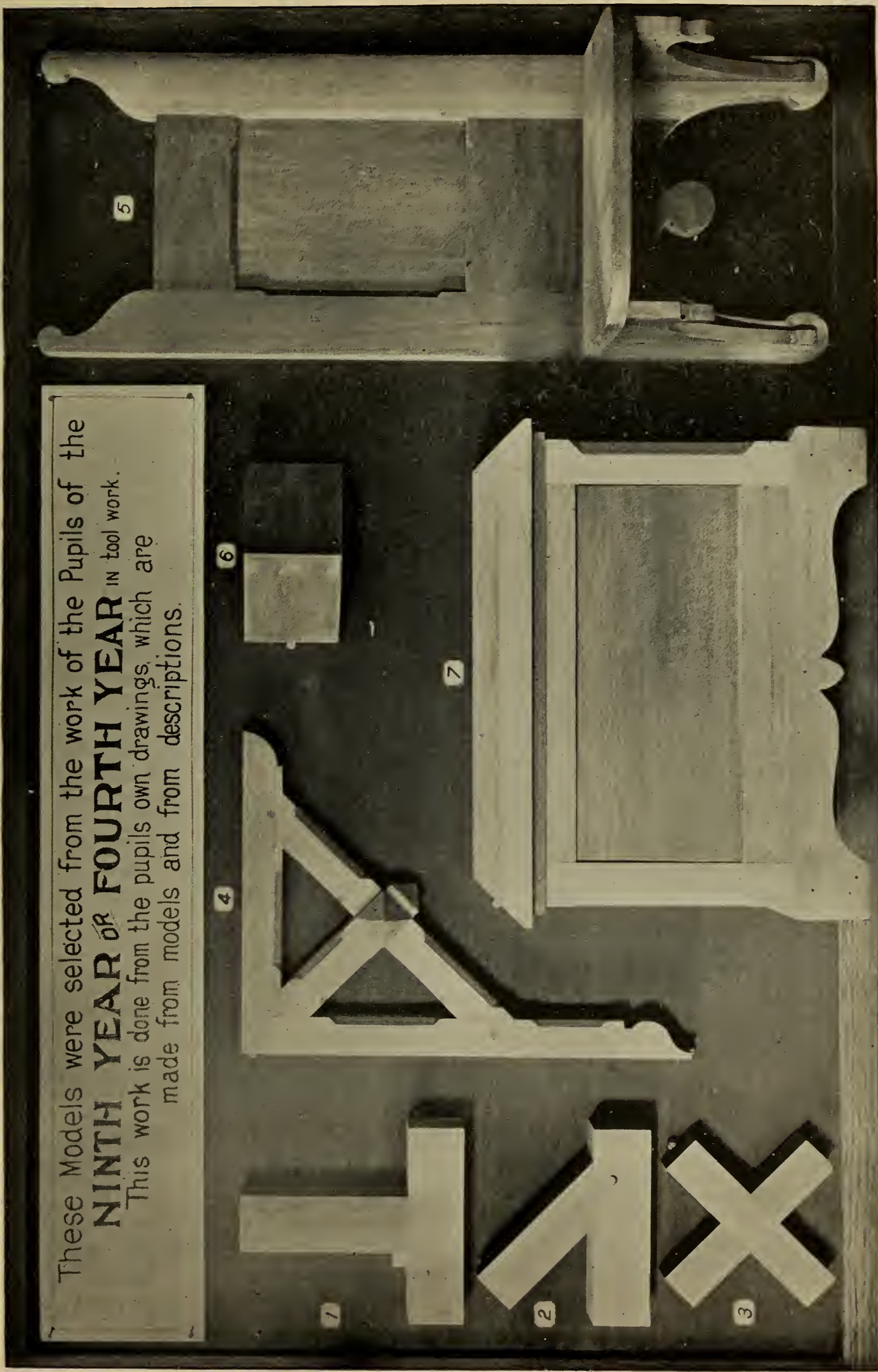
These Models were selected from the work of the Pupils of the
NINTH YEAR OR FOURTH YEAR IN tool work.
This work is done from the pupils own drawings, which are
made from models and from descriptions.
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Plate IV.


NOT ONLY IS HE IDLE WHO IS DOING NOTHING, BU
HE WHO MIGHT BE BETTER EMPLOYED.

Plate V.

FIRST YEAR.

Preliminary Sloyd.

CHILDREN 11–12 YEARS. TIME, 2 HOURS A WEEK.

DRAWING.	New Exercises.	New Tools.	No.	Models Representing the Exercises.	Kind of Wood.	Dimensions (Inches).
Practice with rule, pencil, try-square in drawing parallel lines.	Measuring and lining, rip and cross-cut sawing.	Rule, pencil, try-square, splitting saw, back saw.	A.	Preparing for Nos. 1, 2, 3.	White-wood.	$7 \times 5 \times \frac{1}{4}$.
Oblong, use of dimension and extension lines, dimensioning.	Planing with and across the grain, sand-papering with block.	Smoothing plane, block plane, bench hook, sand-paper.	1	Ruler.	White-wood.	$6 \times 1 \times \frac{1}{4}$.
Oblique lines, dimension fraction.	Oblique planing.		2	Label.	White-wood.	$5 \times 1 \times \frac{1}{4}$.
Circle, semi-circle dimension.	Boring and filing.	Compass, centre bit, flat file.	3	Key tag.	White-wood.	$4 \times 1\frac{1}{2} \times \frac{1}{4}$.
Use of centre lines.	Gluing sand-paper.		4	Pencil sharpener.	Cherry.	$5\frac{1}{2} \times 1\frac{1}{4} \times \frac{3}{16}$.
Dimensioning spaces.	Curve sawing, smoothing with spoke shave.	Turning saw, spoke shave.	5	Round mat.	White-wood.	$6 \times \frac{1}{4}$.
Square.	Filing right angles.		6	Thread winder.	White-wood.	$2\frac{1}{4} \times 2\frac{1}{4} \times \frac{1}{4}$,
Quarter foil.	Filing quarter foil.		7	Quarter-foil mat.	Cherry.	$6 \times 6 \times \frac{3}{16}$.
Right-angle triangle.	Block planing without bench hook.		8	Triangle.	Maple.	$5 \times 5 \times \frac{1}{8}$.
Compound curves.	Boring arcs.		9	Fish-line winder.	White-wood.	$6 \times 1\frac{1}{4} \times \frac{1}{4}$.
Ellipse.	Modelling with spoke shave.		10	Cutting board.	Pine.	$11\frac{1}{2} \times 8 \times \frac{1}{2}$.
Find centre of arc with given radius.	Filing symmetrical curves.	Half-round file.	11	Yarn winder.	Cherry.	$3\frac{1}{2} \times 2 \times \frac{3}{16}$.
Pentagon.	Filing bevel.		12	Vase stand.	White-wood.	$5\frac{1}{4} \times 5\frac{1}{4} \times \frac{1}{4}$.
Quadrant.	Screwing hooks.	Brad awl.	13	Key board.	Cherry.	$8 \times 2\frac{3}{4} \times \frac{3}{16}$.
Detail drawing.	Nailing.	Hammer, nail set.	14	Bracket.	White-wood.	$13 \times 4\frac{1}{2} \times \frac{1}{4}$.
Drawing from description.	Compass sawing.	Compass saw.	15	Frame.	Cherry.	$8\frac{1}{2} \times 6\frac{1}{4} \times \frac{3}{16}$.

SECOND YEAR.

CHILDREN 12-13 YEARS. TIME, 2 HOURS A WEEK.

DRAWING.	New Exercises and Review of Preliminary Course.	Tools Used.	No.	Models Representing the Exercises.	Kind of Wood.	Dimensions (Inches).
Working drawings, full size, including free-hand curves and simple geometrical problems, excepting Nos. 6, 11 and 13, when the children read another's drawing.	Straight, oblique and cross whittling.	Knife, ruler, lead-pencil.	1	Wedge.	Pine.	$3 \times 1 \times \frac{1}{4}$.
	Point whittling, sand-papering (without block).	Sand-paper.	2	Flower pin.	Pine.	$12 \times \frac{1}{2}$.
	Rip sawing, edge planing, squaring.	Rip saw, jack plane, try-square.	3	Flower stick.	Pine.	$15 \times \frac{1}{2} \times \frac{1}{2}$.
	Boring with drill bit, fitting peg, curve whittling.	Bit brace, drill bit.	4	Penholder.	Pine.	$7\frac{1}{2} \times \frac{1}{2}$.
	Cross-cut sawing, gauging, end planing (in bench hook), auger bit, sand-papering (with block).	Cross-cut saw, marking gauge, block plane, bench hook, auger bit.	5	Tool rack.	Pine.	$16 \times 1\frac{3}{4} \times \frac{3}{4}$.
	Curve sawing, smoothing with spoke shave, boring with brad awl.	Turning saw, spoke shave, brad awl.	6	Coat hanger.	Pine.	$15\frac{1}{2} \times 1\frac{3}{8} \times \frac{3}{4}$.
	Surface planing, vertical chiselling, horizontal boring, filing, end planing (without bench hook).	Chisel, flat file, compass.	7	Cutting board.	Pine.	$18 \times 7 \times \frac{5}{8}$.
	Nailing, sinking nails.	Hammer, nail set.	8	Flower-pot stand.	Pine.	$15 \times 5\frac{1}{8} \times 1\frac{7}{16}$.
	Making halved-together joints.		9	Flower-pot stool.	Pine.	$5\frac{1}{2} \times 1 \times \frac{3}{8}$.
	Countersinking, gluing, screwing.	Countersink, screw driver.	10	Bench hook.	Pine and cherry.	$14 \times 5\frac{1}{2} \times 1\frac{3}{8}$.
	Modelling with spoke shave, scraping.	Cabinet scraper, half-round file.	11	Hatchet handle.	Beech.	$14 \times 1\frac{3}{4} \times \frac{3}{4}$.
	Bevelling with spoke shave.		12	Corner bracket.	Pine.	$10 \times 10 \times 1\frac{1}{2}$.
	Oblique planing.		13	Hammer handle.	Beech.	$12 \times 1\frac{1}{4} \times \frac{3}{4}$.

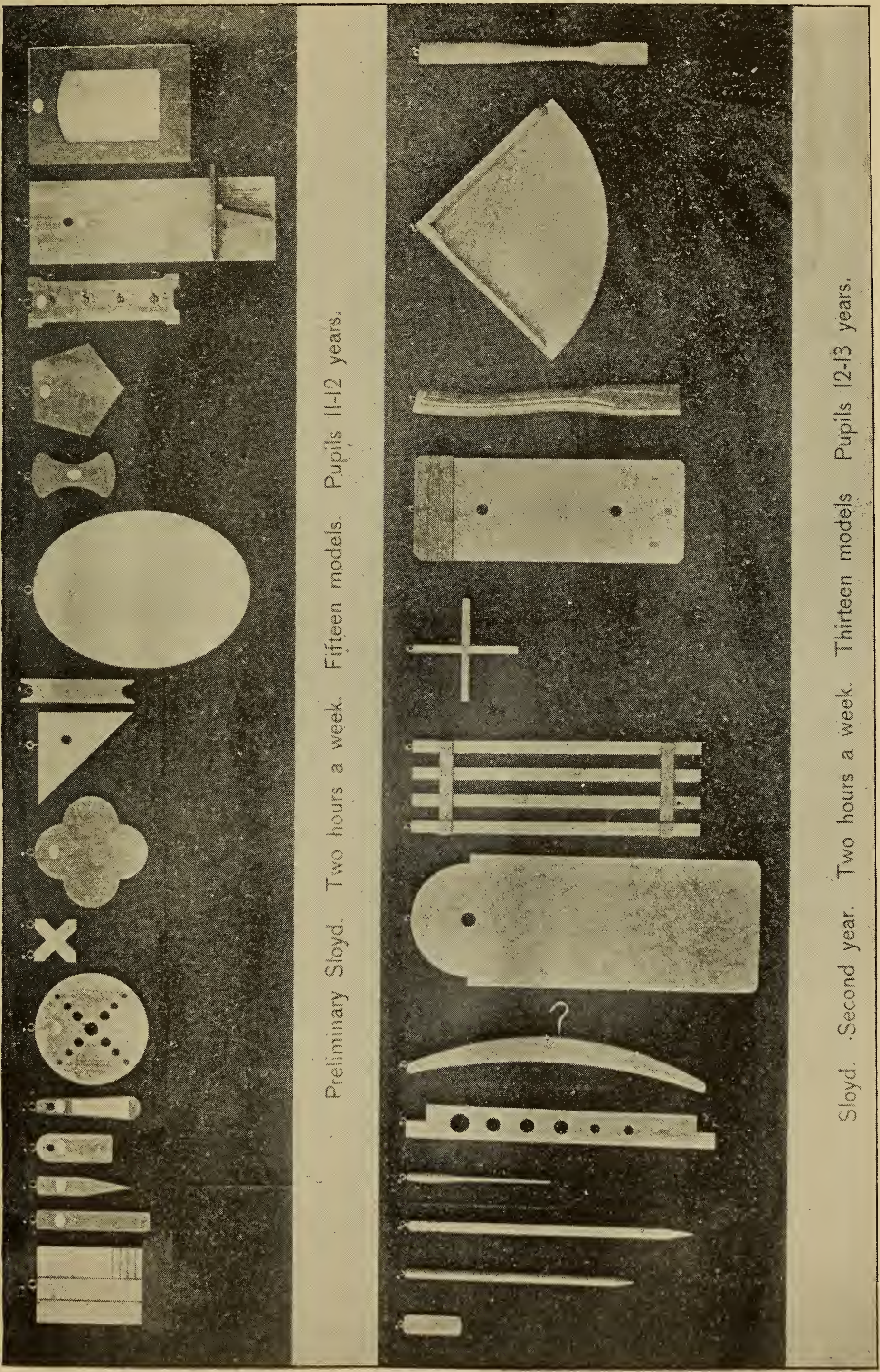
Preliminary Sloyd. Two hours a week. Fifteen models. Pupils 11-12 years.
Sloyd. Second year. Two hours a week. Thirteen models. Pupils 12-13 years.

Plate VI.

THIRD YEAR.

CHILDREN 13-14 YEARS. TIME, 2 HOURS A WEEK.

DRAWING.	New Exercises and Review of Preceding Work.	New Tools.	No.	Models Representing the Exercises.	Kind of Wood.	Dimensions (Inches).
The same as the second year, increasing in difficulty as the models become more complex.	Spacing with compass, veining, carving.	Veiner, skew chisel.	14	Key board.	Pine.	$15 \times 2 \times \frac{1}{2}$.
	Wedge planing, filing edge, notching, punching.	Round file, carver's punch.	15	Paper knife.	Maple.	$13 \times 1\frac{1}{4} \times \frac{1}{4}$.
	Bevelling edge with jack plane and file, boring with centre bit.	Centre bit.	16	Ruler.	Maple.	$16 \times 1\frac{3}{4} \times \frac{3}{16}$.
	Planing a cylinder, fitting axle.		17	Towel roller.	Pine.	$18\frac{3}{4} \times 4\frac{1}{4} \times 2\frac{1}{4}$.
	Open mortise and tenon joint, making and fitting dowels.	Mortise gauge, mallet.	18	Frame.	Pine.	$10 \times 8 \times \frac{3}{4}$.
	Fitting and nailing square joints.		19	Box.	White-wood.	$11 \times 5 \times 2\frac{3}{8}$.
	Grooving with gouge.	Gouge, round cabinet scraper.	20	Pen tray.	Gum wood.	$10\frac{1}{2} \times 2\frac{1}{4} \times \frac{3}{4}$.
	Chamfering, straight-edge bevelling.		21	Hat rack.	Pine.	$18 \times 2\frac{1}{4} \times 3\frac{1}{2}$.
	Half lapping, grooving with chisel.		22	Picture frame.	Pine.	$10 \times 8\frac{3}{4} \times \frac{1}{2}$.
	Compass sawing.	Compass saw.	23	Cake spoon.	Cherry.	$13 \times 2 \times \frac{5}{8}$.
	Grooving with rabbet plane, mitring.	Bevel, rabbet plane.	24	Picture frame.	Cherry.	$8\frac{1}{8} \times 6\frac{1}{4} \times \frac{7}{16}$.

FOURTH YEAR.

Children 14-15 Years. Time, 2 Hours a Week.

Drawing.	New Exercises and Review of Preceding Work.	New Tools.	No.	Models Representing the Exercises.	Kind of Wood.	Dimensions (Inches).
Working drawings to scale and from description; difference between orthographic and isometric projection and perspective drawing; lettering work and making blue prints.	Half oblique dovetail.		25	Foot stool.	Pine.	$13 \times 7 \times 6$.
	Vertical gouging, cutting with drawing knife.	Drawing knife.	26	Scoop.	Cherry.	$9\frac{1}{2} \times 1\frac{3}{8} \times 2\frac{3}{4}$.
	Plain dovetailing, carving curve design.	Parting tool.	27	Book rack or bracket.	Pine.	$16 \times 5\frac{1}{4} \times 6\frac{1}{2}$ or $8\frac{1}{2} \times 7 \times 5$.
	Square grooving, half-round bevelling with plane.		28	Knife box.	Pine.	$12\frac{1}{2} \times 9 \times 2\frac{9}{16}$.
	Plain jointing, use of matching plane, cleating.	Jointer plane, matching plane.	29	Drawing board.	Pine.	$19 \times 13 \times \frac{1}{2}$.
	Dovetailing with mitre, shellacking.		30	Tray.	Cherry and mahogany.	$16 \times 10\frac{5}{16} \times 2\frac{1}{2}$.
	Panel grooving, half-blind dovetailing, blind mortise and tenon joint, fitting hinges and lock, polishing.	Framing chisel, plough, mitre box.	31	Tool chest.	Pine.	$27\frac{1}{4} \times 13\frac{1}{2} \times 9\frac{3}{4}$.

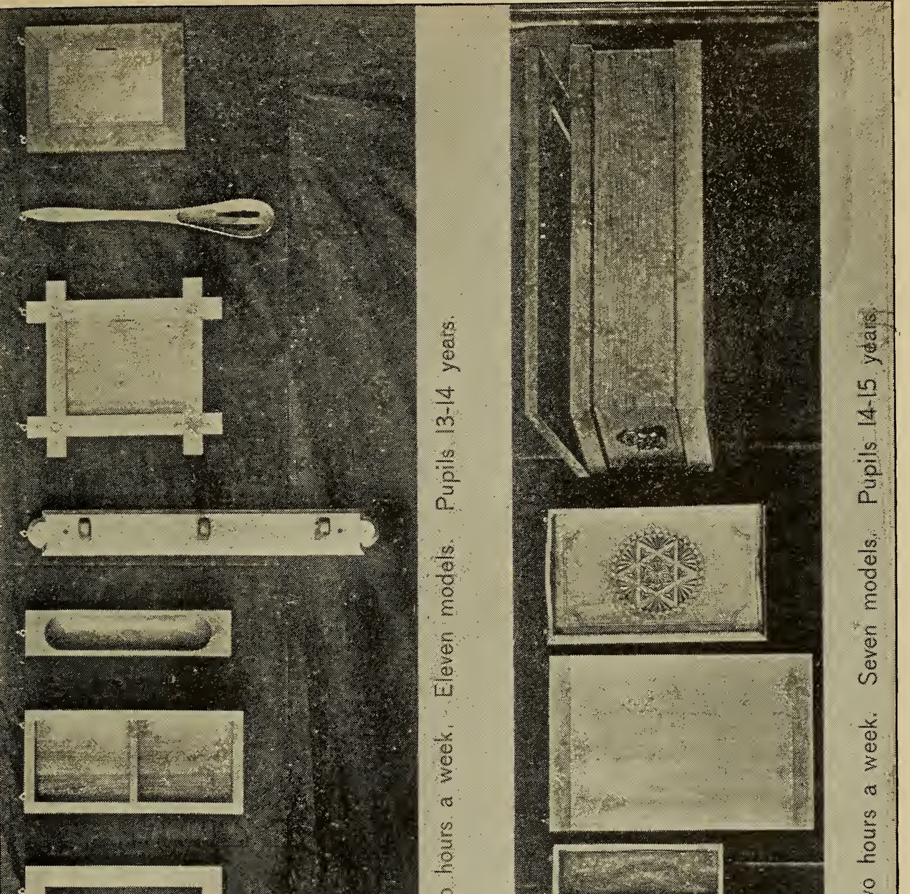
Sloyd. Third year. Two hours a week. Eleven models. Pupils 13-14 years.
Sloyd. Fourth year. Two hours a week. Seven models. Pupils 14-15 years.

Plate VII.

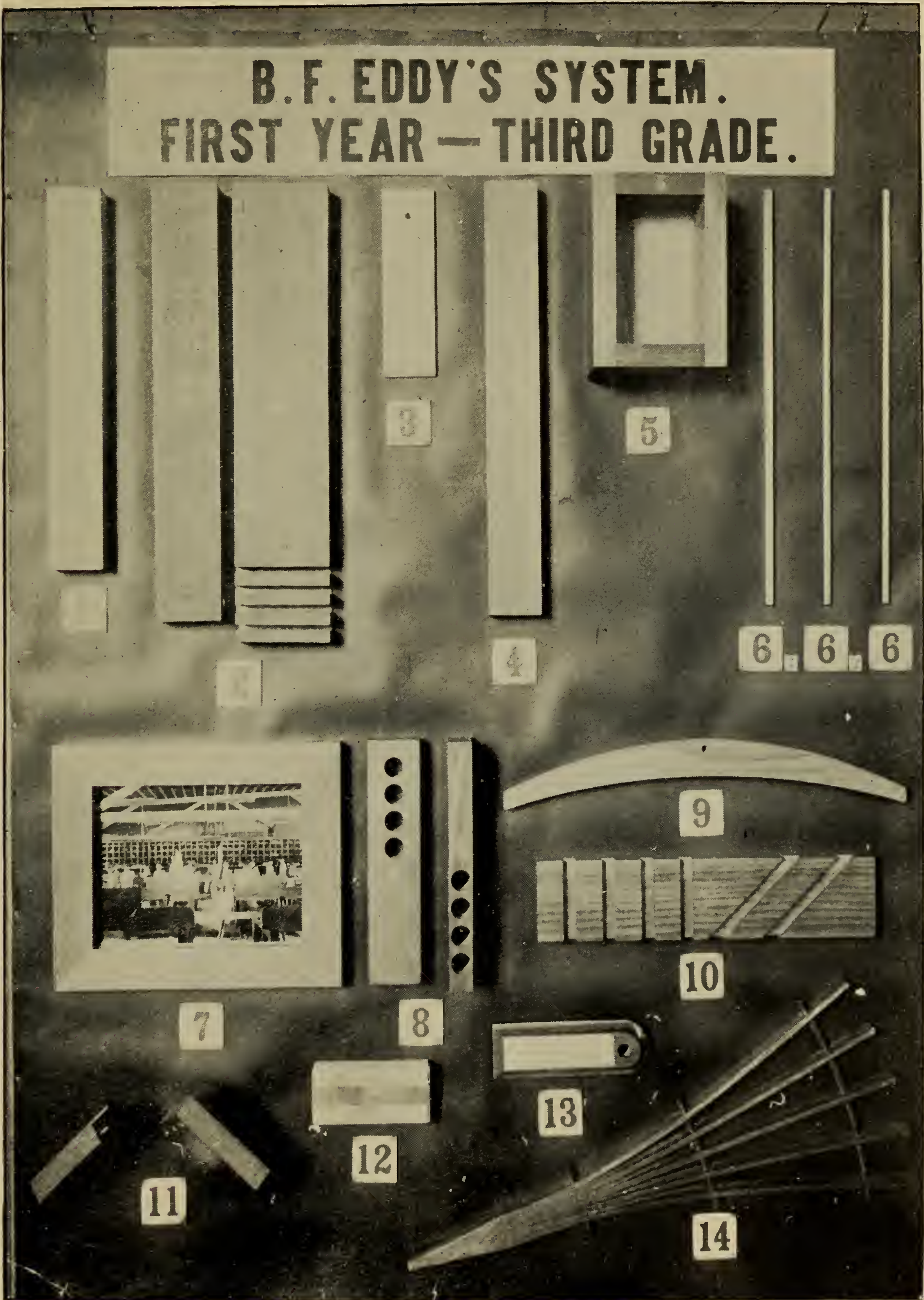
B. F. EDDY'S SYSTEM.
FIRST YEAR — THIRD GRADE.
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Plate VIII.

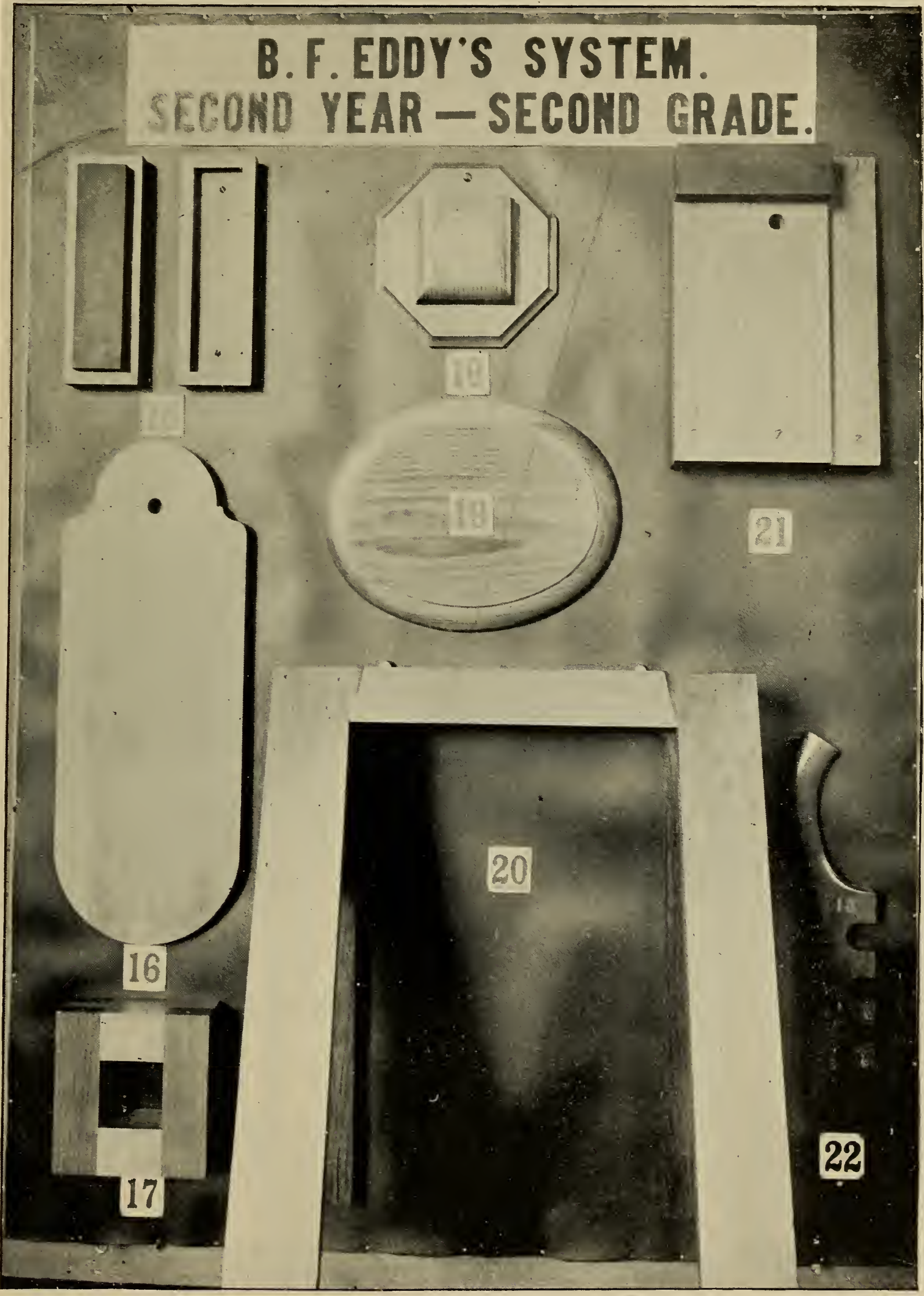

Plate IX.

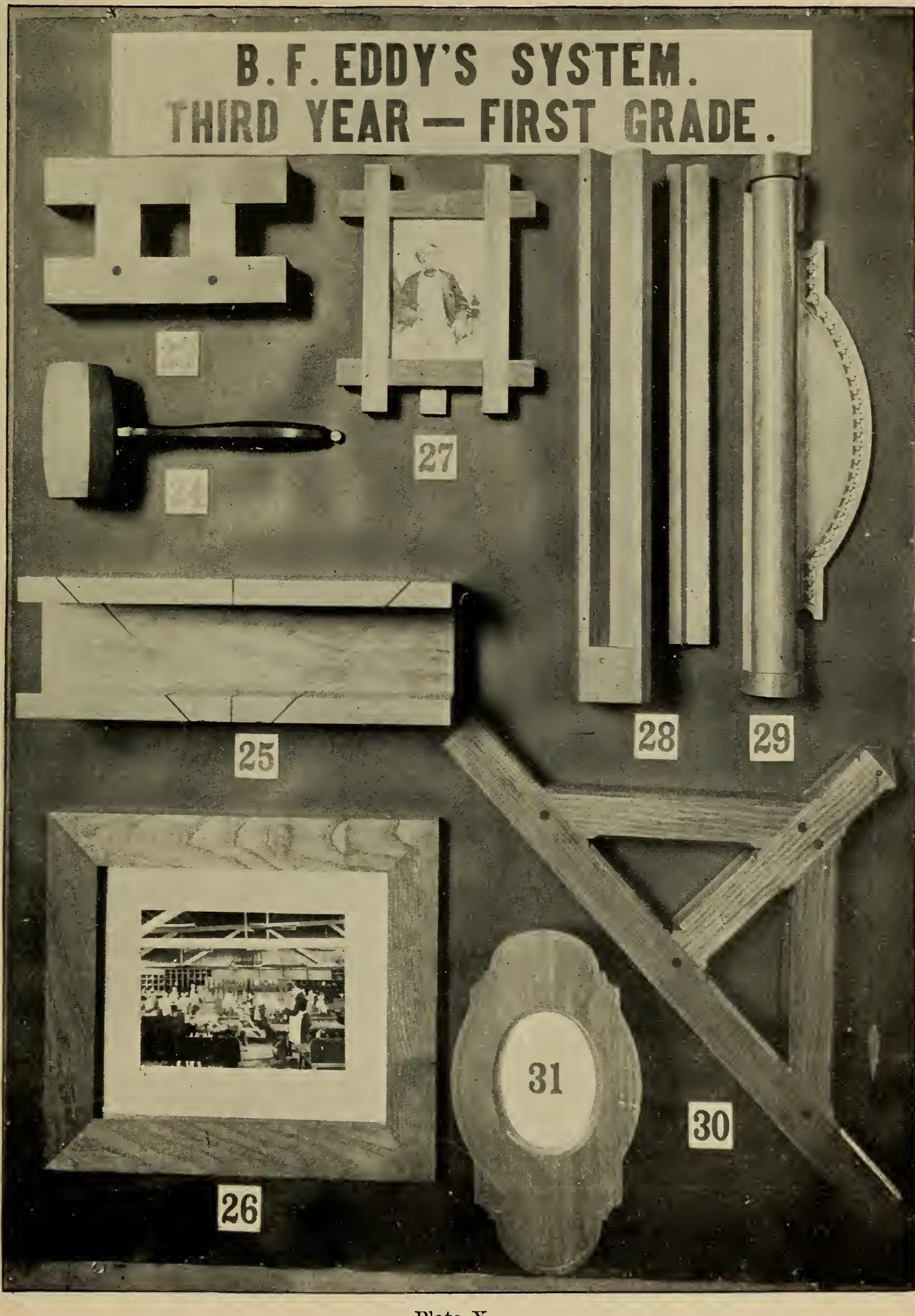

Plate X.

Plate XI.

Plate XII.

Plate XIII.

APPENDIX G.

A COURSE IN MANUAL TRAINING: THE WOOD-WORKING EXERCISES CARRIED ON IN THE NORTH BENNET STREET INDUSTRIAL SCHOOL, WITH FULL SPECIFICATIONS AND DIRECTIONS.

BY B. F. EDDY, TEACHER OF WOOD-WORKING.

The system of elementary and progressive wood-work here presented is the result of nine years of effort to meet in a rational way the demand for manual training. It is elementary, in that it begins with the fundamental process of getting out the stock from the rough material; progressive, in pursuing the instruction by what seem natural and necessary steps to the completion of the successive models. It has gradually assumed its present form as the result of actual experience in teaching wood-work to pupils from the upper grades of the Boston grammar schools. It is by no means offered as a finality, since the experience of the future, like that of the past, will doubtless suggest changes, some of which will be adopted as improvements, while others will, after trial, be rejected as not fulfilling their promise. One of the latest changes, contemplated for several years but delayed perhaps too long, is the introduction of more curved work, consistent with the system with which it is embodied, — a change at last resolved upon after a recent careful study of the much-modified sloyd models used by a leading exponent of sloyd in this country.

Careful preliminary drawings on paper form an essential part of the system herein set forth. It is not merely theoretically desirable that such drawings should be done. Drawing each model, not from dictation alone but from scrutiny of the model itself, must actually precede its construction in wood, in order that the pupil may form a clear idea, a well-digested plan, prior to any attempt at execution. Some one has well said in substance that careful drawings are, to those who are familiar with their mean-

ing, what pictures are to children, showing at a glance what it is beyond the power of words to express.

Careful instruction is given as to the nature of the different woods used; the selection of stock; the construction, correct use and care of tools. It appears highly desirable that pupils should be taught to sharpen their own tools; and the writer's experience justifies the assertion, hitherto much disputed, that by means of a suitable exercise such instruction is both practicable and productive of good results. The constant aim is to reach the highest attainable degree of thoroughness, rather than to execute in a given time a stated number of models.

After the pupil in manual training has been led to grasp the problem before him, and to an understanding of the manipulation necessary to give it effect, he should, after completing any piece of work, be trained to a critical estimate of his results; in order, first, to develop his judgment, and second, to render him more painstaking in subsequent endeavors. For this purpose a plan has been devised and put into operation whereby each pupil tests and marks his own completed models, in accordance with a carefully explained scheme. In practice pupils show a tendency to severity of criticism toward their own products. The experiment is resulting so successfully in attaining the ends sought that it is likely to become a permanent feature of this system of instruction.

If but one two-hour lesson a week can be given, the completion of the models here offered will occupy not less than three years. Supplementary exercises for those pupils who show especial aptitude for manual work, involving, as they must, principles already taught, are suggested as a means of keeping the members of a class within range of class instruction.

Models for First Year (Third Grade*).

MODEL No. 1.

Measuring and Lining Exercise.

Material, $\frac{7}{8}''$ white-wood. Sawing dimensions, prepared for pupil. Planing dimensions, $14'' \times 2'' \times \frac{7}{8}''$, prepared for pupil.

New exercises: —

In Drawing. — Measuring, and drawing horizontal, vertical and diagonal lines.

In Bench Work. — Marking with gauge, try square and bevel.

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* By "third grade" the writer means Class III. in the Boston grammar schools. It is the *seventh year of school.*

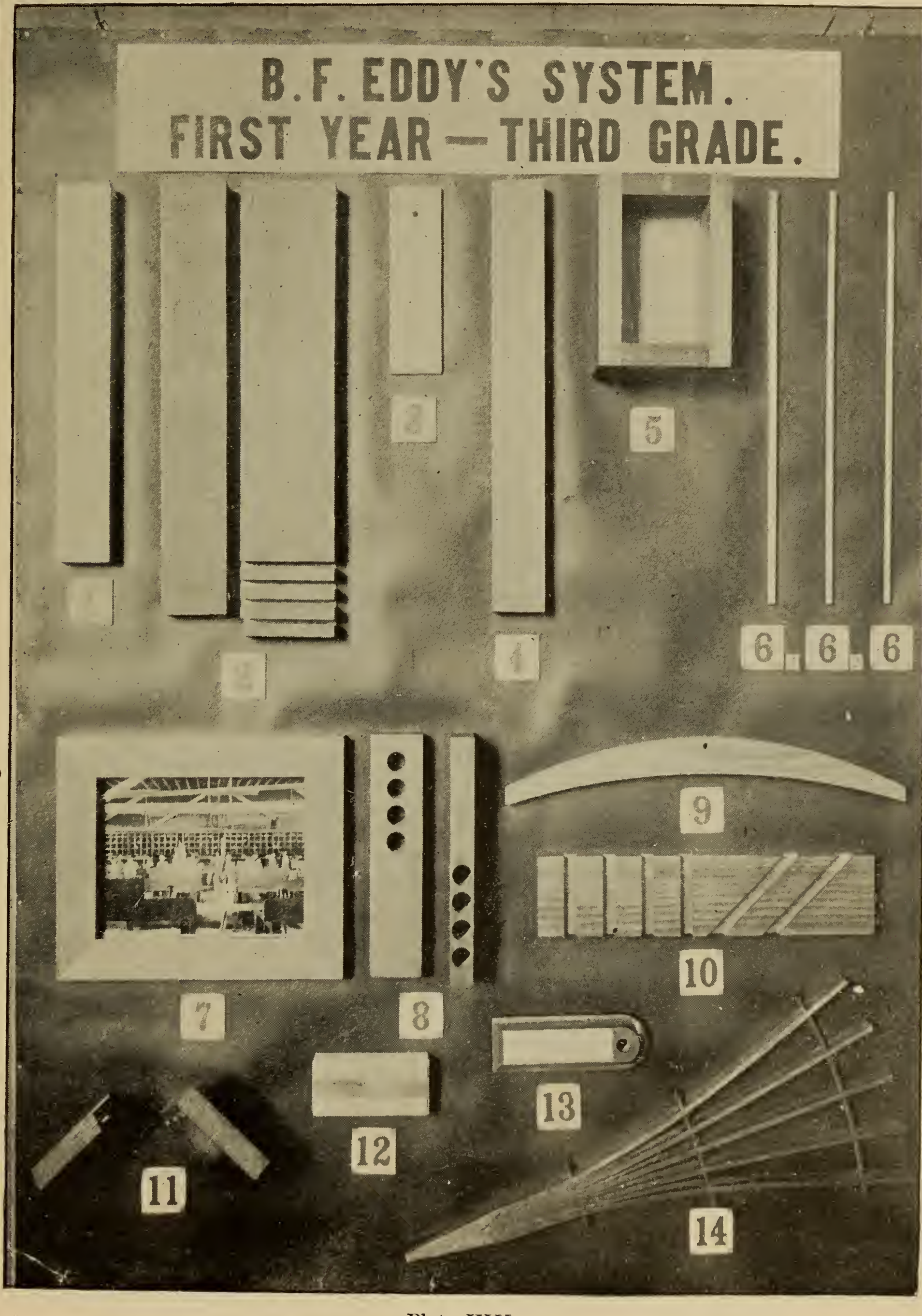

Plate VIII.

New tools: —

For Drawing. — Thumb tacks, rule, T square, 90° and 45° triangles.

For Bench Work. — Marking gauge, rule, try square and bevel.

Order of Exercises.

1. On the entire length of No. 1 surface, with the rule held on its edge, mark off 2″ measurements.
2. With the beam of the try square pointing to the left, and held close to No. 2 surface, draw lines through the 2″ measurements across the wood.
3. With the head of the marking gauge * held close to No. 2 surface, gauge seven lines ¼″ apart the entire length of No. 1 surface.
4. With the beam of the bevel pointing to the left, and held close to No. 2 surface, adjust the blade to an angle of 45° and bisect the second, fourth and sixth squares.

Analysis for marking: —

Dimensions, 52; gauging, 28; angles, 20; total, 100.

MODEL No. 2.

SAWING EXERCISES.

Materials, 1″ pine (rough). Sawing dimensions, 16″ x 6″ x 1″.

New exercises: —

In Bench Work. — Gauging line with pencil and rule; rip and cross-cut sawing to lines with board resting horizontally on trestles; testing the angle of the cut before it is completed; testing the angle of the cut after it is completed; preventing the uncut portion from breaking or splintering; rip sawing in gauge line with piece held upright in the vise.

New tools: —

For Bench Work. — Rip or splitting saw, cross-cut saw, trestles and vise.

Order of Exercises.

1. On one side † of a 1″ rough pine board mark out a piece 16″ x 6″, gauging the width with the pencil and rule.
2. Saw with the splitting saw just outside of the longer line, holding the saw vertically when finishing the cut.
3. Saw with the cross-cut saw just outside of the end line. To prevent breaking or splintering, support the piece when the cut is nearly finished.
4. Select and mark the straighter edge.
5. Gauge from the marked edge on both sides 2½″.

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* The gauge must be set by using the rule, and not by the graduation on the gauge itself.

† The long, wide surfaces are the sides, the long, narrow surfaces are the edges, and the short, narrow surfaces are the ends.

6. Being careful to keep the vise post parallel with the bench post, place the piece upright in the vise and saw in the lines, reversing the sides of the piece occasionally. Lay the narrower piece aside for model No. 4.
7. Mark the straighter edge of the wider piece. On one side from one end and parallel with an edge make four dots, the first $\frac{1}{2}''$ from the end, the second $\frac{1}{2}''$ from the first, and so on in succession, guessing at the distances.
8. With the beam of the square held close to the marked edge, draw lines through the $\frac{1}{2}''$ measurements. Saw just outside of the lines, so as to leave the lines on the larger piece, testing each time with the try square. The large piece is set aside for the chiselling exercise No. 10.

Analysis for marking: —

Dimensions, 40; straight edges, 30; angles, 30; total, 100.

MODEL No. 3.

Sharpening Exercise.

Material, $\frac{1}{8}''$ white holly. Planing dimensions, $7'' \times 2'' \times \frac{1}{8}''$, prepared for pupil.

New exercises: —

In Bench Work. — Sharpening or bevelling with sand-paper block.

New tools: —

For Bench Work. — Sand-paper block.

Order of Exercises.

1. Measure $\frac{1}{4}''$ from one end on one of the wide surfaces, and with the try square and pencil draw a line through the $\frac{1}{4}''$ measurement across the wood.
2. With the lined end resting on the sand-paper block at an angle of about 30° from the horizontal, move the wood forward and backward until a bevel is formed, changing the square, blunt end to a sharp one.
3. Remove the square corners of the sharp end slightly.

Analysis for marking: —

Dimensions, 30; bevel, 35; corners, 20; cleanliness, 15; total, 100.

MODEL No. 4.

Planing Exercise.

Material, $1''$ pine. Sawing dimensions, $16'' \times 2\frac{1}{2}'' \times 1''$ (sawed in No. 2). Planing dimensions, $16'' \times 2'' \times \frac{7}{8}''$.

New exercises: —

In Bench Work. — Planing one side flat; testing flat surface with winding sticks; using reference marks; jointing* an edge; planing to gauge lines.

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* An edge is jointed when it is straight lengthways and at right angles with one side.

New tools: —

For Bench Work. — Jointer plane, straight edge and winding sticks.

Order of Exercises.

1. Being careful to plane with the grain, plane one side flat; test in three ways and mark the side No. 1.
2. Joint one edge; test and mark No. 2.
3. With the marking gauge set at 2″ and held close to No. 2 surface, gauge a line the entire length on both sides; plane the unfinished edge to the lines.
4. Gauge from No. 1 surface on both edges $\frac{7}{8}$″, and plane the unfinished side to the lines. Set aside for models No. 8 and No. 13.

Analysis for marking: —

Dimensions, 48; angles, 30; finish, 22; total, 100.

MODEL No. 5.

Nail Box with Square Joints.

Materials, $\frac{7}{8}$″ pine wood, eight $1\frac{1}{2}$″ finishing nails, ten No. 16 1″ wire brads. Sawing dimensions, two pieces, $12\frac{1}{2}$″ x $2\frac{1}{2}$″ x $\frac{7}{8}$″; one piece, $7\frac{1}{2}$″ x $5\frac{1}{2}$″ x $\frac{1}{2}$″. Planing dimensions, two pieces, 7″ x 2″ x $\frac{7}{8}$″; two pieces, $3\frac{1}{4}$″ x 2″ x $\frac{7}{8}$″; one piece, $7\frac{1}{16}$″ x $5\frac{1}{16}$″ x $\frac{7}{16}$″.

New exercises: —

In Drawing. — Three dimensions, invisible, connecting and dimension lines, and arrow heads.

In Bench Work. — Back sawing square ends; using bench hook; block planing; awl boring; nailing square joints, and nail setting.

New tools: —

For Bench Work. — Back saw, bench hook, block plane, brad awl, hammer, nail set, smoothing plane.

Order of Exercises.

1. From a $\frac{7}{8}$″ board saw two pieces $12\frac{1}{2}$″ x $2\frac{1}{2}$″; select and mark one flat side of each.
2. Joint one edge of each, and then gauge and plane both pieces 2″ wide.
3. From a $\frac{1}{2}$″ board saw one piece $7\frac{1}{2}$″ x $5\frac{1}{2}$″.
4. Plane one side flat; joint one edge; block plane one end square; gauge and plane $\frac{7}{16}$″ thick.
5. On one side of each of the frame pieces, about $\frac{1}{4}$″ from one end, draw a pencil line squarely across; carry the line squarely across the nearer edge, rest the piece on the bench hook, and saw just outside of the lines with the back saw, taking great pains to saw squarely.
6. If necessary, make the ends square with the block plane, holding the piece in the vise. From each piece make two pieces, one 7″ long, the other $3\frac{1}{4}$″ long.

7. Clean one side of each of the pieces with the smoothing plane set very fine.
8. Place the two 7″ pieces on the bench with the clean side down. Bore two holes with the $\frac{1}{16}$″ brad awl about $\frac{7}{16}$″ from the two ends and edges half-way through and start the nails.
9. Place one of the short pieces upright in the vise, and nail one of the long pieces to it. Do the same with the other two pieces.
10. Nail the two halves together on the bench.
11. Nail the bottom board on so that the corner of the frame will fit the square corner of the bottom board, and saw off its extra length and width.
12. Set all the nails below the surface with the nail set.
13. Finish the outside of the box with smoothing plane.

Analysis for marking: —

Dimensions, 35; nailing, 35; angles, 15; finish, 15; total, 100.

MODEL No. 6.

Dowel.

Material, $\frac{3}{8}$″ pine. Sawing dimensions, $15\frac{1}{2}$″ x $\frac{3}{8}$″ x $\frac{3}{8}$″. Planing dimensions, $15\frac{1}{2}$″ x $\frac{1}{4}$″ x $\frac{1}{4}$″.

New exercises: —

In Bench Work. — Gauging line with pencil and fingers; octagonal and cylindrical whittling; filing and sand-papering.

New tools: —

For Bench Work. — Knife, flat file and sand-paper.

Order of Exercises.

1. Prepare a piece, $15\frac{1}{2}$″ x $\frac{1}{4}$″ x $\frac{1}{4}$″, with saws and plane.
2. Gauge $\frac{1}{16}$″ with fingers and pencil the entire length on all sides from each corner.
3. Remove the wood from the corners to the lines, using the knife, making the stick eight sided.
4. Remove the remaining corners with the file.
5. Smooth with No. $\frac{1}{2}$ sand-paper, twisting the stick; smooth with the grain with No. 0 sand-paper.
6. Set aside for model No. 14.

Analysis for marking: —

Dimensions, 40; uniformity, 30; finish, 30; total, 100.

MODEL No. 7.

Picture Frame with Mitred Joints.

Material, pine wood; four No. 13 2″ wire nails. Sawing dimensions, two pieces, 20″ x 2″ x $\frac{7}{8}$″. Planing dimensions, two pieces, 20″ x $1\frac{1}{2}$″ x $\frac{3}{4}$″.

New exercises: —

In Bench Work. — Back sawing mitred corners; block planing mitred corners; rabbet planing; gluing and nailing mitred joints.

New tools: —

For Bench Work. — Rabbet plane.

Order of Exercises.

1. From a $\frac{7}{8}''$ pine board saw two pieces, $20'' \times 2''$.
2. Plane one side of each piece flat, and mark it No. 1. Joint one edge of each piece and mark it No. 2.
3. Gauge and plane both pieces $1\frac{1}{2}''$ wide, gauge and plane both pieces $\frac{3}{4}''$ thick.
4. On No. 1 side of each of the pieces, about $\frac{1}{4}''$ from one end, with the bevel set at 45° and held close to No. 2 surface, draw a pencil line; carry the line square across the nearer edge.
5. Place the piece in the vise with the marked side up, and start the back saw just outside the 45° line; finish the sawing with the piece held on the bench hook.
6. Test the end with the bevel (making sure that the bevel retains its 45° angle) and try square, and make perfectly true with the block plane. From each piece make two pieces, one 11″ long, the other 9″ long, cut at 45°.
7. Set the rabbet plane so as to cut $\frac{1}{4}''$ wide and $\frac{1}{4}''$ deep, and remove the corner formed by the inner edge and back side of each piece.
8. Place the pieces in position on the bench, and number the joints 1, 2, 3 and 4. Glue and rub together Nos. 1 and 3. After the glue has become set, or hardened, strengthen each corner with a No. 13 2″ wire nail, starting the nail about 1″ from the end in the longer pieces when the longer way of the frame is to be placed horizontally, and in the shorter pieces when the frame is to be placed the other way. Glue and nail the remaining joints in the same manner, being careful not to jam the sides of the frame in the vise.
9. Set all of the nails and finish the frame with the smoothing plane and No. 0 sand-paper, being careful not to sand-paper across the grain.
10. Oil the frame with raw linseed oil; after the oil has dried, rub with a dry cloth.

Analysis for marking: —

Dimensions, 48; angles, 16; joints, 12; nailing, 12; finish, 12; total, 100.

MODEL No. 8.

Boring Exercise.

Material, pine, prepared in Nos. 2 and 4, except in length. Sawing dimensions, $9\frac{1}{4}'' \times 2\frac{1}{2}'' \times 1''$. Planing dimensions, $9'' \times 2'' \times \frac{7}{8}''$.

New exercises: —

In Drawing. — Centring and drawing circles.

In Bench Work. —Perpendicular boring across the grain entirely through; perpendicular boring across the grain to a given depth.

New tools: —

For Bench Work. — Auger bit $\frac{3}{4}''$, wing dividers.

Order of Exercises.

1. Block plane one end of model No. 4 square.
2. Measure 9″ from the square end, and saw the piece off just outside of the line; plane to the line. Set the extra piece aside for model No. 13.
3. Lay off centres for holes with gauge and dividers, and prick them. Accuracy in laying out the centres is of utmost importance.
4. Place the piece in the vise horizontally, with the upper side even with the top of the vise, and start the spur of the bit at the first centre. Bore until the bit will stand upright alone.
5. Move away from the bit a few feet, and see if it stands vertically. Bore until the spur protrudes on the under side. Bore the three remaining holes in the same manner.
6. Complete the boring entirely through by turning the piece in the vise.
7. Place the piece in the vise horizontally, with the upper edge even with the top of the vise; start the spur of the bit at the first centre and bore, keeping count of the revolutions, and testing the depth of the hole frequently with the rule until a depth of $1\frac{1}{2}''$ is reached, being careful to use no downward pressure on the bit. Bore the three remaining holes in the same manner, using the same number of revolutions.
8. Clean the model with smoothing plane.

Analysis for marking: —

Dimensions, 30; boring, 32; angles, 20; finish, 18; total, 100.

MODEL No. 9.

COAT-HANGER.

Material, $\frac{7}{8}''$ pine. Sawing dimensions, $16'' \times 3'' \times \frac{7}{8}''$. Planing dimensions, $15\frac{1}{2}'' \times 2\frac{8}{4}''$* $\times \frac{3}{4}''$.

New exercises: —

In Drawing. — Plotting free-hand curves, and showing complete section.

In Bench Work. — Using turning saw, spoke shave, cabinet scraper; making concaved edge square with side; making convexed edge curved.

New tools: —

Bench Work. — Turning saw, spoke shave, cabinet scraper, $\frac{1}{4}''$ auger bit.

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* One edge jointed.

Order of Exercises.

1. From a $\frac{7}{8}''$ pine board saw a piece $16'' \times 3''$.
2. Make one side flat, joint one edge, block plane the ends and make the piece $\frac{3}{4}''$ thick.
3. Plot the curve on the first side (see drawing) ; bore the hole, being careful not to bore entirely through without turning the piece in the vise.
4. Place the piece in the vise and saw with the turning saw about $\frac{1}{8}''$ outside the lines, standing directly in front of the piece ; point the saw straight ahead, avoid twisting the saw, and saw with the grain, so as to leave the smooth side of the kerf on the model.
5. Spoke shave and file to the lines, keeping the edges square.
6. Gauge with the finger nail and pencil $\frac{1}{8}''$ from the top edge on both sides.
7. Form the curve on the top edge with the spoke shave, file and cabinet scraper.
8. Clean both sides with the smoothing plane, and finish with No. 0 sand-paper.

Analysis for marking : —

Dimensions, 40 ; curves, 30 ; boring, 12 ; finish, 18 ; total, 100.

MODEL No. 10.

CHISELLING EXERCISE.

Material, pine. Sawing dimensions, $14'' \times 3\frac{1}{2}'' \times 1''$. (From No. 2.) Planing dimensions, $13'' \times 3'' \times \frac{7}{8}''$.

New exercises : —

In Bench Work. — Lining with knife point ; vertical chiselling across the grain ; chiselling out grooves with open ends of uniform width and depth, at 90° and 45° angles.

New tools : —

For Bench Work. — $1\frac{1}{2}''$ socket firmer chisel ; $\frac{3}{8}''$ socket firmer chisel ; hand screw, mallet.

Order of Exercises.

1. Prepare a piece, $13'' \times 3'' \times \frac{7}{8}''$, with ends planed square.
2. Draw the construction on the first side ; place the rule on its edge, and measure very carefully, using the knife point in marking the lines.
3. Saw with the back saw just inside of the $\frac{1}{2}''$ spaces, not quite $\frac{3}{8}''$ deep.
4. Secure the piece to the bench with a hand screw, keeping the jaws of the hand screw parallel. Remove the wood between the saw kerfs with the $1\frac{1}{2}''$ chisel, held on a slant with the bevel side down.
5. With the wide chisel held vertically and the bevel side held toward the wood to be removed, cut the walls $\frac{3}{8}''$ deep.

6. Place the piece in the vise with one edge up, the bottom toward you. Pare down to the $\frac{3}{8}''$ line with the $\frac{3}{8}''$ chisel half way through. Reverse the piece in the vise, and finish in the same manner, being careful to make the bottom of the grooves flat.
7. Clean with the jointer plane set very fine.

Analysis for marking: —

Dimensions, 45; angles, 20; uniformity, 18; finish, 17; total, 100.

MODEL No. 11.

Blind Dowel Joint at Corner.

Material, 1″ pine and $\frac{1}{2}''$ black walnut. Sawing dimensions, one piece, $8\frac{1}{2}'' \times 3\frac{1}{2}'' \times 1''$; one piece, $3'' \times \frac{1}{2}'' \times \frac{1}{2}''$. Planing dimensions, two pieces, $4'' \times 3'' \times \frac{7}{8}''$; one piece, $3'' \times \frac{3}{8}'' \times \frac{3}{8}''$.

New exercises: —

In Bench Work. — Making rabbet.

Order of Exercises.

1. Prepare two pieces, $4'' \times 3'' \times \frac{7}{8}''$.
2. From the end on the marked side of one of the pieces measure the thickness of the other, and square a line across the side and from the ends of this line $\frac{3}{4}''$ on each edge.
3. From the marked side gauge $\frac{3}{4}''$ from the squared line on one edge around the nearer end to the squared line on the other.
4. Rough out the rabbet with the back saw.
5. In finishing with the chisel place the piece in the vise with the edge up, and cut in the edge lines about $\frac{1}{8}''$ deep; place the piece flat on the bench with the marked side up, and finish cutting the end. With the piece held upright in the vise, finish the length of the rabbet.
6. From the marked side gauge $\frac{3}{8}''$ across the end of the rabbet. From the end of the other piece gauge $\frac{3}{8}''$ across the marked side.
7. From the marked edge of each piece on the gauged lines lay off with the gauge $\frac{3}{8}''$, $1\frac{1}{2}''$, $2\frac{5}{8}''$.
8. At the six intersections of the gauged lines as centres bore $\frac{3}{8}''$ holes $\frac{7}{16}''$ deep.
9. Make the $\frac{3}{8}''$ dowel same as in model No. 6, and cut from it three pieces $\frac{7}{8}''$ long.
10. Glue the dowels in the holes in the end of the rabbet.
11. Clean the model with the smoothing plane.

Analysis for marking: —

Dimensions, 40; boring, 18; joint, 18; finish, 24; total, 100.

MODEL No. 12.

Sand-paper Block.

Material, $\frac{7}{8}''$ pine wood, $\frac{1}{4}$ sheet of sand-paper. Sawing dimensions, block, $5'' \times 2\frac{1}{2}'' \times \frac{7}{8}''$; key, $5'' \times \frac{7}{8}'' \times \frac{1}{2}''$. Planing dimensions, block, $4\frac{1}{2}'' \times 2'' \times \frac{3}{4}''$; key, $4\frac{1}{2}'' \times \frac{3}{4}'' \times \frac{3}{8}''$.

New exercises: —

In Bench Work. — Horizontal chiselling lengthways of the grain; fitting key to groove; chiselling square ends of key.

New tools: —

For Bench Work. — $\frac{5}{8}''$ socket primer chisel.

Order of Exercises.

1. Prepare a piece, $4\frac{1}{2}'' \times 2'' \times \frac{3}{4}''$, with ends block planed.
2. Gauge the construction lines.
3. Place the piece in the vise with the gauged side up, and saw with the back saw just inside of the groove lines not quite $\frac{3}{8}''$ deep.
4. Score out the groove between the kerfs not quite to the bottom line. Finish the groove with the $1\frac{1}{2}''$ and $\frac{5}{8}''$ chisels, cutting the side walls with the wider chisel held vertically, drawing the chisel sideways as well as pressing down.
5. Prepare a piece, $5'' \times \frac{3}{4}'' \times \frac{3}{8}''$, with sawed ends.
6. At about $\frac{1}{16}''$ from the end of the piece square a line on the sides and edges with a knife. With the bevel side of the wide chisel turned toward the end to be removed, the cutting edge of the chisel placed in the squared line, and the chisel held upright, cut down about $\frac{1}{8}''$ on the sides and edges. Repeat the process until the chisel cuts off all the wood to the centre of the end. Measure from the square end $4\frac{1}{2}''$, square a line around, saw just outside of the line, and chisel as before.
7. Fold $\frac{1}{4}$ sheet of sand-paper around the block, and secure it in place with the key.

Analysis for marking: —

Dimensions, 36; groove, 30; angles, 24; finish, 10; total, 100.

MODEL No. 13.

THUMB TACK HOLDER AND PENCIL POINTER.

Material, pine wood, prepared except in length in Nos. 2 and 4, No. 0 sand-paper. Sawing dimensions, $6\frac{1}{4}'' \times 2'' \times \frac{7}{8}''$. Planing dimensions, $6\frac{1}{8}'' \times 2'' \times \frac{7}{8}''$.

New exercises: —

In Bench Work. — Chiselling curved end; chamfering; quarter fluting; and gluing sand-paper.

New tools: —

For Bench Work. — Gouge.

Order of Exercises.

1. Block plane one end of piece left from model No. 8.
2. Measure $5''$ from the square end, and square a line around the piece; find the centre of the lines on both sides.
3. Draw the curved construction lines with the dividers and the straight lines with the gauge.
4. Bore the hole.

5. With the piece held in the vise, chamfer the two ends and then the edges on one side.
6. Remove the corners from the other side with the gouge.
7. Cut and glue on the piece of No. 0 sand-paper.

Analysis for marking: —

Dimensions, 45; curves, 15; chamfering, 12; fluting, 12; finish, 16; total, 100.

MODEL No. 14.

Flower Trellis.

Material, $\frac{7}{8}''$ pine wood, dowel from No. 6; fifteen No. 19 $\frac{5}{8}''$ wire brads. Sawing dimensions, $20\frac{1}{2}'' \times 1\frac{3}{4}'' \times \frac{7}{8}''$. Planing dimensions, $20'' \times 1\frac{1}{4}'' \times \frac{3}{4}''$.

New exercises: —

In Drawing. — Arrows showing dimensions which extend outside of material used, broken drawing.

In Bench Work. — Spreading and bending slats; oblique chiselling and planing.

Order of Exercises.

1. Prepare a piece, $20'' \times 1\frac{1}{4}'' \times \frac{3}{4}''$.
2. Lay off centres for holes on both edges with the try square and gauge.
3. Place the piece in the vise with one edge up, and bore the holes about half way through; reverse the edges and bore way through.
4. Make the construction lines for the pointed end, and place the piece in the vise so that the end will project a little beyond the end of the bench; cut nearly to the oblique lines with the wide chisel, and finish to the lines with the smoothing plane.
5. Measure 15″ from the wide end, and square a pencil line around the wood.
6. Gauge the four 15″ lines from the marked edge on both sides, beginning at the squared line.
7. Place the piece in the vise in a vertical position, having the end about 5″ above the top of the bench, and saw down about 4″ in each of the four gauge lines; repeat the process until the squared line is reached.
8. From model No. 6 cut three pieces of the lengths shown in the drawing, and make a light pencil mark $\frac{1}{8}''$ on each side of the centre of the length of each piece.
9. Place the three dowels through the holes in the slats so as to have the pencil marks on the dowels even with the sides of the centre slat; secure in place by nailing through the centre slat into the dowels.
10. Fasten a hand screw to the piece just below where the slats end, to prevent splitting; spread the slats according to distances shown in the drawing each side of the centre and fasten in place with nails.

Analysis for marking: —

Dimensions, 30; sawing, 32; boring, 15; nailing, 15; finish, 8; total, 100.

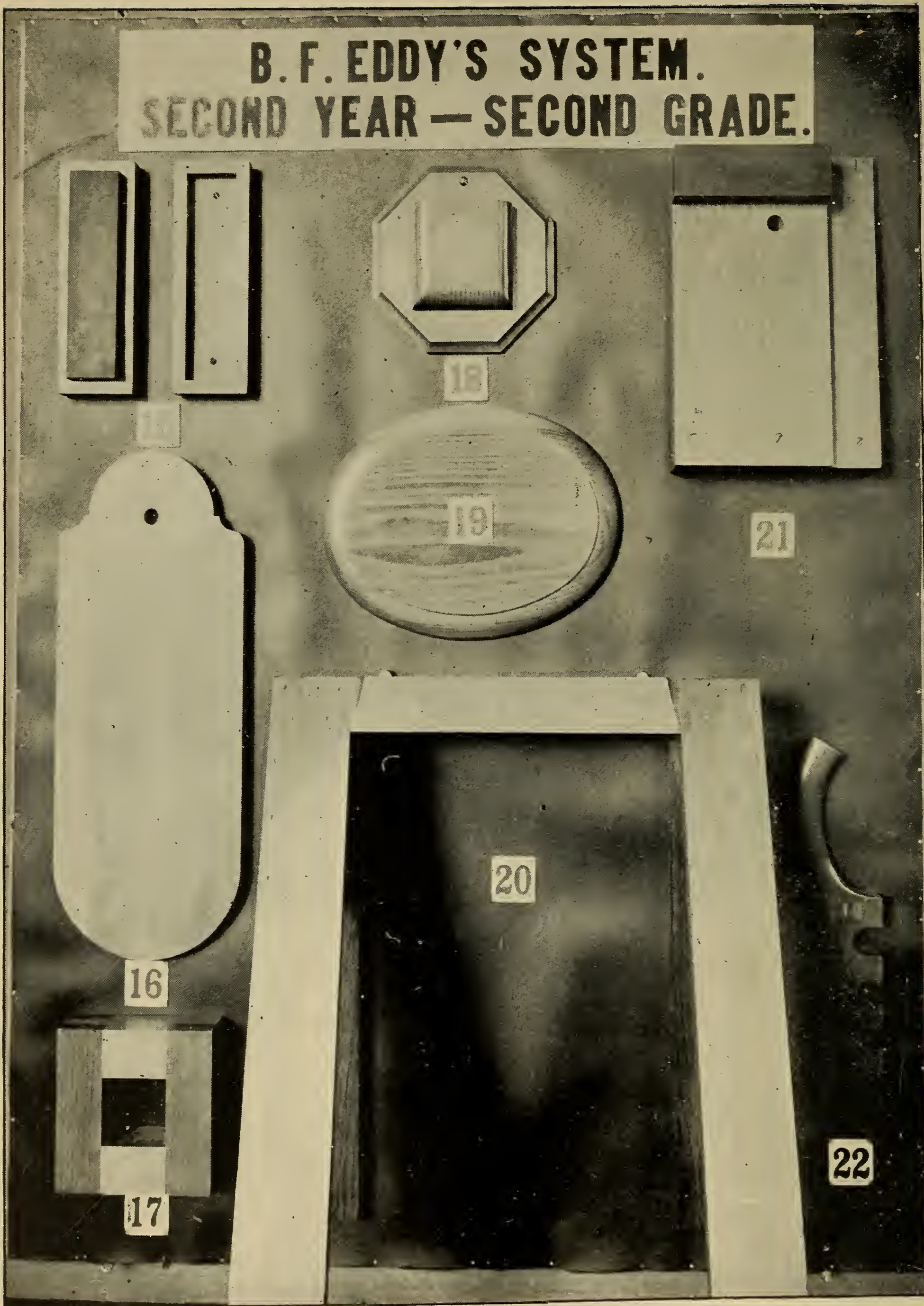

Plate IX.

Models for Second Year (Second Grade*).

MODEL No. 15.

Tool-strop Box.

Material, $\frac{7}{8}''$ and $2\frac{1}{4}''$ pine wood; leather $8'' \times 2'' \times \frac{1}{16}''$; four $\frac{3}{8}''$ brads. Sawing dimensions, box, one piece, $18\frac{1}{2}'' \times 3\frac{1}{2}'' \times \frac{7}{8}''$; block, one piece, $8\frac{1}{2}'' \times 2\frac{1}{4}'' \times 1\frac{3}{8}''$. Planing dimensions, two pieces, $9'' \times 3'' \times \frac{13}{16}''$; one piece, $8'' \times 2'' \times 1\frac{1}{8}''$.

New exercises: —

In Bench Work. — Chiselling out grooves with closed ends; filing points of brands.

New tools: —

For Bench Work. — Safe edge, smooth file.

Order of Exercises.

1. Prepare two pieces for box, $9'' \times 3'' \times \frac{13}{16}''$.
2. Prepare one piece for block, $8'' \times 2'' \times 1\frac{1}{8}''$.
3. On the first side of the two box pieces gauge $\frac{1}{2}''$ from the marked edge and one end of each.
4. Place the block on one of the pieces so as to have the edge and end fit the gauge lines, and with the point of the knife mark along the opposite edge and end; repeat the process on the other box piece.
5. Secure one of the box pieces to the top of the bench by means of a hand screw; hold the wide chisel vertically just inside of the end lines with the bevel toward the wood to be removed, and strike the chisel lightly with the mallet; move the chisel about $\frac{1}{4}''$ farther away from the end line with its bevel side down, and remove the wood between it and the vertical cut. Repeat the process at the ends of both pieces until a depth of about $\frac{1}{2}''$ is reached.
6. Cut vertically directly in the end lines.
7. Score out the wood between the ends not quite to the side lines to the depth of about $\frac{1}{2}''$.
8. Place one of the pieces in the vise horizontally and pare down in the side lines. Smooth out to a depth of $\frac{9}{16}''$. Do the same to the other piece to the depth of $\frac{5}{8}''$.
9. Chamfer the cover.
10. On the bottom, about $\frac{1}{4}''$ from each corner, drive a $\frac{3}{8}''$ brad, leaving the heads projecting about $\frac{1}{16}''$.
11. File the brad heads to a point with the safe edge file.
12. Glue the leather to the block, placing the glue on the wood, and when dry trim it even with the block.
13. Put the box together and sand-paper the outside.

Analysis for marking: —

Dimensions, 45; angles, 20; uniformity, 18; chamfering, 8; finish, 9; total, 100.

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* Class II. in the Boston grammar schools, or *eighth year of school.*

MODEL No. 16.

Pressing or Cutting Board.

Material, $\frac{7}{8}''$ pine. Sawing dimensions, $19\frac{1}{2}'' \times 4\frac{1}{4}'' \times \frac{7}{8}''$, two pieces. Planing dimensions, $19\frac{1}{4}'' \times 7\frac{1}{2}'' \times \frac{11}{16}''$, one piece.

New exercises: —

In Bench Work. — Planing wide surface; jointing and gluing edges.

Order of Exercises.

1. Joint one edge of each of the sawed pieces.
2. Glue and rub the edges together.
3. Plane one side flat; gauge the thickness and plane to lines; joint one edge; gauge and plane width.
4. Bore the centre hole and those which form part of the construction, and saw with turning saw just outside of the curves.
5. Finish with spoke shave, file and sand-paper.

Analysis for marking: —

Dimensions, 30.; angles, 20; joint, 20; finish, 30; total, 100.

MODEL No. 17.

Joints.

Corner joints, halved-together joint, open mortise and tenon joint, half-dovetail and dovetail joint. Material, $1\frac{7}{8}''$ pine. Sawing dimensions, one piece, $12\frac{1}{2}'' \times 4'' \times 1\frac{7}{8}''$. Planing dimensions, four pieces, $6'' \times 1\frac{3}{4}'' \times 1\frac{3}{4}''$.

New exercises: —

In Bench Work. — Laying out and cutting the four joints.

Order of Exercises.

1. From a $1\frac{7}{8}''$ plank saw a piece $12\frac{1}{2}'' \times 4''$.
2. Plane one side flat and joint one edge.
3. Gauge the $1\frac{3}{4}''$ thickness and plane to the line.
4. Block plane the ends square.
5. Measure 6″ from both ends, and with the try square and knife draw lines entirely around the piece.
6. Saw just outside of the lines, and block plane to them.
7. From the marked edge gauge $1\frac{3}{4}''$ and then $1\frac{15}{16}''$.
8. Saw between the lines and plane to them, marking the new surface on the unfinished piece No. 2.
9. Gauge the two unfinished pieces $1\frac{3}{4}''$, and plane to the lines.
10. In laying out the joints do all the gauging from the upper or first side of each piece.
11. With two of the pieces lay out the halved-together joint and remove the wood as in No. 11.
12. With the right-hand piece and a third piece lay out the mortise and tenon joint.

13. In removing wood from mortise bore as in No. 8 near the blind end with a bit of proper size, and rough out with back saw, finishing with chisel.
14. On right-hand end of third piece and a fourth piece lay out the half-dovetail joint, drawing the oblique lines with the knife point.
15. Remove the wood as before, using care on the oblique lines to cut from the end of the wood toward the centre.
16. On the right-hand end of the fourth piece and the left-hand end of the first piece, lay out the dovetail joint and remove the wood as before.
17. Glue the joints together and clean the model with the smoothing plane and fine sand-paper.

Analysis for marking: —

Dimensions, 36; joints, 40; angles, 16; finish, 8; total, 100.

MODEL No. 18.

MATCH SAFE.

Material, 1″ and $\frac{1}{2}$″ pine wood; No. $\frac{1}{2}$ sand-paper; three 1″ No. 6 screws; two $\frac{3}{4}$″ No. 6 screws. Sawing dimensions, one piece, $4\frac{1}{2}$″ x $4\frac{1}{2}$″ x 1″; one piece, $7\frac{3}{4}$″ x $7\frac{3}{4}$″ x $\frac{1}{2}$″. Planing dimensions, one piece, 4″ x 4″ x $\frac{7}{8}$″; one piece, $7\frac{1}{4}$″ x $7\frac{1}{4}$″ x $\frac{7}{16}$″.

New exercises: —

In Drawing. — Three views, geometrical problem, — to construct a regular octagon within a square.

In Bench Work. — Making quarter-round moulding, fluting, countersinking and screwing

New tools: —

For Bench Work. — German bit, countersink and screw driver.

Order of Exercises.

1. Prepare a piece, $7\frac{1}{4}$″ x $7\frac{1}{4}$″ x $\frac{7}{16}$″.
2. Draw the construction for the octagon, remove the wood from the corners with the back saw, sawing just outside of the lines. Block plane to the lines
3. Bore the hole; gauge the lines on the first side, edges and ends, and remove the corners with a gouge; finish the fluted parts with fine sand-paper wound about a dowel.
4. Bore and countersink the holes for the screws, finishing with sand-paper.
5. Prepare a piece, 4″ x 4″ x $\frac{7}{8}$″.
6. Draw the construction lines for the quarter-round moulding and cut the end first, using chisel, file and sand-paper. Cut the edges in the same manner.
7. Flute the pockets with the gouge, using a narrow chisel at the ends.
8. Screw the two parts together. Cut and glue the sand-paper.

Analysis for marking: —

Dimensions, 32; quarter-round moulding, 18; pockets, 10; quarter fluting, 16; screwing, 10; finish, 14; total, 100.

MODEL No. 19.

Bread Trencher.

Material, $\frac{7}{8}''$ pine. Sawing dimensions, $12\frac{1}{2}'' \times 9\frac{1}{2}'' \times \frac{7}{8}''$. Planing dimensions, $12\frac{1}{2}'' \times 9\frac{1}{2}'' \times \frac{7}{8}''$.

New exercises: —

In Drawing. — Geometrical problem, — to draw a curve approximating an ellipse, having given the major axis.

In Bench Work. — Cutting a fillet and quarter-round moulding.

Order of Exercises.

1. Saw from a flat $\frac{7}{8}''$ board a piece $12\frac{1}{2}'' \times 9\frac{1}{2}''$, and on it construct the curves.
2. Saw with the turning saw just outside of the line.
3. Spoke shave to the line, keeping the edge square.
4. Secure the piece to the bench with a hand screw and chisel down just outside of the inner curve not quite $\frac{1}{8}''$ deep.
5. Remove the rabbet with the chisel, having the direction of the stroke toward the outside, to avoid injuring the shoulder.
6. Being careful that the chisel is held vertically, chisel to the curve line.
7. Model the curved moulding with the chisel, and finish with file and sand-paper.

Analysis for marking: —

Dimensions, 40; curves, 32; shoulder, 16; finish, 12; total, 100.

MODEL No. 20.

Trestle.

Material, $2\frac{1}{4}''$ and $\frac{7}{8}''$ pine wood; sixteen No. 13 $2''$ wire nails. Sawing dimensions, one piece, $18\frac{1}{2}'' \times 4\frac{1}{2}'' \times 2\frac{1}{4}''$; four pieces, $20\frac{1}{2}'' \times 3\frac{1}{2}'' \times \frac{7}{8}''$; one piece, $6\frac{1}{4}'' \times 9\frac{1}{4}'' \times \frac{7}{8}''$. Planing dimensions, one piece, $18'' \times 4'' \times 2''$; four pieces, $20\frac{1}{2}'' \times 3'' \times \frac{7}{8}''$; one piece, $6'' \times 9\frac{1}{4}'' \times \frac{7}{8}''$.

New exercises: —

In Drawing. — To scale ($\frac{1}{2}$ size).

Order of Exercises.

1. Prepare a piece, $18'' \times 4'' \times 2''$.
2. With the try square and knife draw lines around the piece $3''$ from each end.
3. On the first side gauge from both edges from these lines to the nearer end $1\frac{1}{4}'$.
4. In like manner gauge on the opposite side $\frac{7}{8}''$.
5. Connect the $1\frac{1}{4}''$ and $\frac{7}{8}''$ lines at each end with the bevel and knife.
6. Remove the corners with the back saw, sawing just outside the lines.
7. Finish to the lines with the chisel, as in model No. 17.
8. Prepare four pieces, $20\frac{1}{2}'' \times 3'' \times \frac{7}{8}''$.

9. Bevel both ends of each piece with the back saw; clean both sides with the smoothing plane.
10. Glue and nail the legs to the top.
11. Block plane the ends of the piece $6\frac{1}{4}'' \times 9\frac{1}{4}'' \times \frac{7}{8}''$, making it 6″ long.
12. Place the trestle upside down on the bench, and draw the converging lines on the end pieces by placing the side of the piece against the outer edge of the legs.
13. Saw just outside of the lines, and plane to the lines with the smoothing plane, testing the edges with the try square.
14. Hold the pieces between the legs by means of a hand screw, and secure in place with glue and nails.
15. Finish the ends and top with smoothing plane.
16. Round the corners of the top piece with a gouge.

Analysis for marking: —

Dimensions, 42; joints, 20; nails, 28; finish, 10; total, 100.

MODEL No. 21.

Bench Hook and Planing Board.

Material, $\frac{5}{8}''$ pine wood, 1″ cherry wood; five $1\frac{1}{2}''$ No. 10 screws; one 1″ No. 10 screw. Sawing dimensions, one piece pine, $12\frac{1}{2}'' \times 8\frac{1}{2}'' \times \frac{5}{8}''$; one piece, $12\frac{1}{2}'' \times 6\frac{1}{2}'' \times \frac{5}{8}''$; one piece cherry, $15'' \times 2\frac{1}{2}'' \times 1''$. Planing dimensions, one piece pine, $12'' \times 8'' \times \frac{1}{2}''$; one piece, $12'' \times 6'' \times \frac{1}{2}''$; one piece cherry, $8'' \times 2'' \times \frac{7}{8}''$; one piece, $6'' \times 2'' \times \frac{7}{8}''$.

New tools: —

For Bench Work. — $\frac{3}{16}''$ German bit.

Order of Exercises.

1. From a $\frac{5}{8}''$ pine board prepare one piece $12'' \times 8'' \times \frac{1}{2}''$ and one piece $12'' \times 6'' \times \frac{1}{2}''$.
2. From a 1″ cherry board prepare one piece $8'' \times 2'' \times \frac{7}{8}''$ and one piece $6'' \times 2'' \times \frac{7}{8}''$.
3. Glue the two pine pieces together.
4. Being careful to have the edges of the cherry pieces at right angles to the edges of the pine pieces, secure them in place by means of glue, hand screws and screws.
5. Bore the hole, and chamfer the corner of the shorter cherry piece.
6. Finish with fine sand-paper.

Analysis for marking: —

Dimensions, 48; angles, 20; screws, 12; finish, 20; total, 100.

MODEL No. 22.

Marble Rake.

Material, $\frac{7}{8}''$ pine. Sawing dimensions, $14\frac{1}{2}'' \times 4'' \times \frac{7}{8}''$. Planing dimensions, $14'' \times 3\frac{3}{4}'' \times \frac{7}{8}''$.*

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* One edge jointed.

New exercises: —

In Drawing. — Free-hand ellipse.

In Bench Work. — Modelling a handle any cross section of which will be an ellipse.

Order of Exercises.

1. Saw out a piece from a $\frac{7}{8}''$ board $14\frac{1}{2}'' \times 4''$.
2. Joint one edge of the piece and block plane one end square.
3. Draw the construction lines.
4. Place the piece horizontally in the vise and bore the holes.
5. With the try square and knife draw lines from the sides of the holes on one side around the jointed edge to the sides of the holes on the opposite side.
6. Being careful to avoid letting the saw scar the sides of the holes, saw with the back saw just inside the knife lines.
7. Chisel to the lines, as in model No. 17.
8. Saw just outside the curved lines with the turning saw.
9. Finish to the lines with the spoke shave, gouge and file.
10. Draw a free-hand ellipse on the end of the handle.
11. Model the handle with the spoke shave, file, cabinet scraper and sand-paper.

Analysis for marking: —

Dimensions, 30; curves, 20; boring, 20; chiselling, 16; finish, 14; total, 100.

Models for Third Year (First Grade*).

MODEL No. 23.

Joints.

Halved-together, half-dovetail, mortise and tenon, and blind mortise and tenon joints.

Material, $1\frac{7}{8}''$ pine, $\frac{1}{2}''$ black walnut. Sawing dimensions, pine, $15\frac{1}{2}'' \times 4'' \times 1\frac{7}{8}''$; black walnut, $4'' \times \frac{1}{2}'' \times \frac{1}{2}''$. Planing dimensions, two pieces pine, $9\frac{1}{2}'' \times 1\frac{3}{4}'' \times 1\frac{3}{4}''$; one piece, $5\frac{1}{2}'' \times 1\frac{3}{4}'' \times 1\frac{3}{4}''$; one piece, $4\frac{3}{4}'' \times 1\frac{3}{4}'' \times 1\frac{3}{4}''$; one piece black walnut, $4'' \times \frac{3}{8}'' \times \frac{3}{8}''$.

New exercises: —

In Bench Work. — Laying out and cutting the four joints; draw-boring and dowelling.

Order of Exercises.

1. Prepare the four pieces as in No. 17.
2. Place the pieces on the bench with the first side up, and letter them *a*, *b*, *c* and *d*, as on the drawing.
3. Lay out the four joints with the try square, knife and gauge, and remove the wood as in model No. 17.

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* Class I. in the Boston grammar schools, or *ninth year of school.*

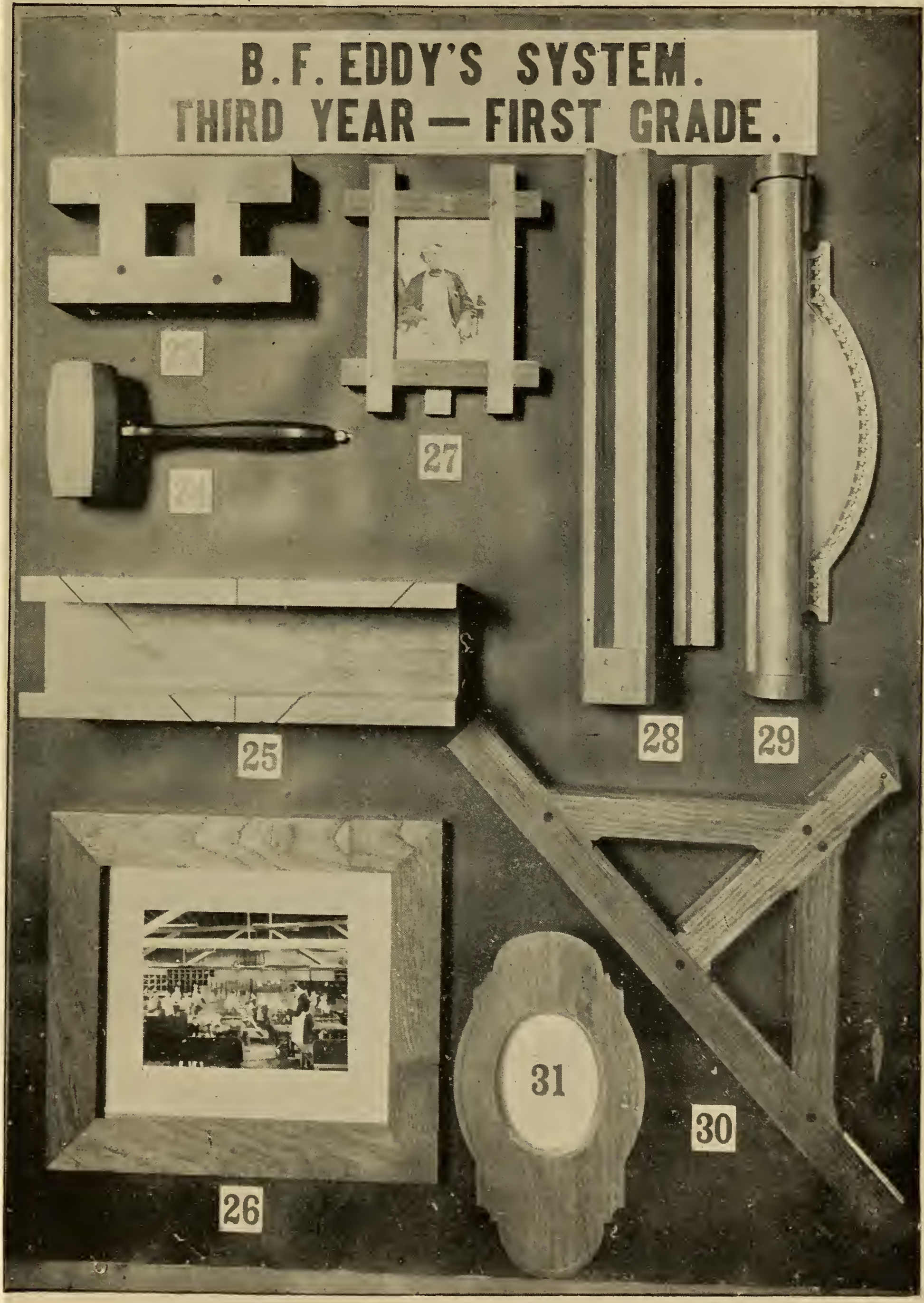


Plate X.

4. From the top side of the *c* piece bore a $\frac{3}{8}''$ hole through the centre of each mortise.
5. Insert the tenons, place the bit in the holes already bored, and press the point against the tenons; withdraw the tenons and bore holes through them, starting the bit a little nearer the shoulder of the tenons than the marks are.
6. Make the dowels, cutting them a little longer than the holes, and drive them in place.
7. Cut off the projecting portion of the dowels, and clean the model with fine sand-paper.

Analysis for marking: —

Dimensions, 36; joints, 24; dowels, 10; angles, 16; finish, 14; total, 100.

MODEL No. 24.

MALLET.

Material, $3''$ maple and $1\frac{1}{8}''$ cherry. Sawing dimensions, one piece maple, $5\frac{1}{2}'' \times 3'' \times 3''$; one piece cherry, $11\frac{1}{2}'' \times 1\frac{1}{8}'' \times 1\frac{1}{8}''$. Planing dimensions, one piece maple, $5'' \times 2\frac{3}{4}'' \times 2\frac{3}{4}''$; one piece cherry, $11\frac{1}{4}'' \times 1'' \times 1''$.

New exercises: —

In Drawing. — Free-hand supple curve.

In Bench Work. — Modelling octagonal handle, wedging.

New tools: —

For Bench Work. — Wing calipers.

Order of Exercises.

1. Prepare a piece of maple, $5'' \times 2\frac{3}{4}'' \times 2\frac{3}{4}''$.
2. Bore a $\frac{5}{8}''$ hole entirely through by boring half-way from opposite sides. Elongate the hole slightly in the direction of the grain at one end.
3. Draw the construction lines for the octagon at each end.
4. Gauge $\frac{1}{4}''$ around on each end.
5. Connect the gauge lines on two opposite sides by free-hand curves.
6. Chisel and file to lines.
7. Connect the gauge lines on the two curved sides, and finish to lines as before.
8. Connect the corners of the octagon at each end on all four sides.
9. Remove the corners to the lines.
10. Prepare a piece of cherry, $11\frac{1}{4}'' \times 1'' \times 1''$.
11. Draw the curved construction lines on opposite sides, free hand, and proceed to make it octagonal, using the same steps and tools as in making the maple head.
12. Make the dowel at the end, and fit it to the head.
13. With the knife split the dowel slightly in the middle at its end.
14. Make the small cherry wedge, and after placing the head and handle together glue and drive the wedge into the split at the end of the handle.

15 Saw off the extra length of the dowel, and wedge and finish with chisel.

16. Finish all with fine sand-paper.

Analysis for marking: —

Dimensions, 42; curves, 32; wedging, 8; finish, 18; total, 100.

MODEL No. 25.

Mitre Box.

Material, $1\frac{7}{8}''$ and $1''$ pine wood; eight $1\frac{1}{2}''$ No. 10 screws. Sawing dimensions, one piece, $16\frac{1}{2}'' \times 3\frac{3}{4}'' \times 1\frac{7}{8}''$; two pieces, $16\frac{1}{2}'' \times 4\frac{3}{4}'' \times 1''$. Planing dimensions, one piece, $16'' \times 3\frac{1}{4}'' \times 1\frac{3}{4}''$; two pieces, $16'' \times 4\frac{1}{4}'' \times \frac{7}{8}''$.

New exercises: —

In Bench Work. — Back sawing between lines.

New tools: —

For Bench Work. — $\frac{5}{32}''$ German bit.

Order of Exercises.

1. Prepare one piece, $16'' \times 3\frac{1}{4}'' \times 1\frac{3}{4}''$.
2. Prepare two pieces, $16'' \times 4\frac{1}{4}'' \times \frac{7}{8}''$.
3. On the marked side of the two pieces just prepared bore and countersink the holes for the screws, using a $\frac{5}{32}''$ bit.
4. Secure the sides to the bottom by means of two hand screws, and fasten in place with eight screws.
5. On the top edges and outsides of the side pieces lay out and draw very carefully the lines between which the saw is to run.
6. Secure the box to the bench with a hand screw, and saw very slowly and carefully between the lines with the back saw.

Analysis for marking: —

Dimensions, 45; angles, 25; sawing, 30; total, 100.

MODEL No. 26.

Picture Frame.

Material, $\frac{7}{8}''$ chestnut wood, $\frac{3}{8}''$ birch dowel. Sawing dimensions, two pieces, $16' \times 2\frac{1}{2}'' \times \frac{7}{8}''$; two pieces, $14'' \times 2\frac{1}{2}'' \times \frac{7}{8}''$; eight dowels, $\frac{3}{4}'' \times \frac{3}{8}'' \times \frac{3}{8}''$. Planing dimensions, two pieces, $16'' \times 2'' \times \frac{3}{4}''$; two pieces, $14'' \times 2'' \times \frac{3}{4}''$.

New exercises: —

In Bench Work. — Mitring with mitre box, dowelling, and clamping mitred corners.

New tools: —

For Bench Work. — Mitre box, bit stop.

Order of Exercises.

1. Prepare two pieces, $16'' \times 2'' \times \frac{3}{4}''$, and two pieces, $14'' \times 2'' \times \frac{3}{4}''$.
2. Saw one end of each piece to an angle of 45°, using the mitre box. Save the triangular ends for future use.

3. Block plane the mitred ends perfectly true, testing with bevel and try square.
4. On the shorter edge of the two longer pieces measure from the mitred end $11\frac{1}{2}''$; square a line across the edge, and with the bevel set at 45° draw a line with the knife point across the first side.
5. Place the pieces in the mitre box and saw just outside the line; finish with block plane, as before.
6. Repeat the process on the two shorter pieces, making them $9\frac{1}{2}''$ long, inside measurement.
7. With the gauge set at half the thickness gauge from the first side the entire length of the mitred ends.
8. On the gauged lines at each end of the two longer pieces measure from the inside edge $\frac{3}{4}''$, and make a fine mark with the knife point; measure again from the inside edge $2''$.
9. Square lines from the measurements to the unmarked side.
10. Place the pieces in position on the bench with the marked side down, and letter the pieces; then mark the $\frac{3}{4}''$ and $2''$ measurements on the shorter pieces, and square lines across the gauged lines.
11. At the intersection of the gauge and knife lines prick the centres for the holes.
12. Secure the bit stop to a $\frac{3}{8}''$ bit, so as to bore a hole but $\frac{3}{8}''$ deep, and bore the holes in each piece, holding the piece in the vise with the mitred end parallel with the top of the bench.
13. On the outside edge of each piece near the ends glue one of the triangular pieces so that the mitred end will be opposite and parallel to the mitred joint.
14. After the glue is dry change the corner formed by the inside edge and unmarked side to a $\frac{1}{4}''$ rabbet, by using the rabbet plane.
15. From a $\frac{3}{8}''$ dowel saw eight $\frac{3}{4}''$ pieces. Place glue on the ends and in the holes at the opposite diagonal corners of the frame, and secure in place until dry with hand screws.
16. Glue the other two corners in the same manner.
17. Finish with the smoothing plane, cabinet scraper and fine sandpaper.

Analysis for marking: —

Dimensions, 48; angles, 24; rabbet, 12; finish, 16; total, 100.

MODEL No. 27.

Cabinet Picture Frame.

Material, $\frac{7}{8}''$ and $\frac{1}{2}''$ pine wood; one No. 16 $1''$ and three No. 18 $\frac{3}{4}''$ wire brads. Sawing dimensions, frame, one piece, $17\frac{3}{4}'' \times 2\frac{1}{2}'' \times \frac{7}{8}''$; hinge and support, one piece, $7\frac{1}{2}'' \times 1\frac{3}{8}'' \times \frac{1}{2}''$; back board, one piece, $7'' \times 4\frac{5}{8}'' \times \frac{1}{2}''$. Planing dimensions, two pieces for frame, $9\frac{3}{8}'' \times 1'' \times \frac{5}{8}''$; two pieces, $7\frac{3}{4}'' \times 1'' \times \frac{5}{8}''$; one piece for hinge and support, $7'' \times 1'' \times \frac{3}{8}''$; one piece for back board, $6\frac{1}{2}'' \times 4\frac{1}{4}'' \times \frac{1}{4}''$.

New exercises: —

In Bench Work. — Rabbeting, fret sawing and making halved-together joint, and hinge joint.

New tools: —

For Bench Work. — Fret saw, $\frac{1}{16}''$ drill.

Order of Exercises.

1. From a $\frac{7}{8}''$ board saw a piece $17\frac{3}{4}'' \times 2\frac{1}{2}''$, from this piece prepare four pieces, two $9\frac{3}{8}'' \times 1'' \times \frac{5}{8}''$ and two $7\frac{3}{4}'' \times 1'' \times \frac{5}{8}''$, using the same steps in making the four pieces as in model No. 17.
2. With the marking gauge, try square and sharp-pointed knife, draw the lines for the halved-together joints.
3. Cut the joints with the back saw and chisel.
4. Glue and clamp the joints in place by using hand screws, and after the glue is dry lay out the rabbet with the gauge.
5. Fasten the frame flat on the bench with the face down, and cut the rabbet with the chisel, scoring nearly to the lines and then paring to the lines.
6. Prepare a piece for the hinge and support, $7'' \times 1'' \times \frac{3}{8}''$.
7. In the centre of the thickness and $1\frac{3}{8}''$ from one end bore a hole with a $\frac{1}{16}''$ drill entirely through.
8. At the same end on one side draw the construction lines for the hinge joint.
9. Fasten the fret-sawing board to the bench by means of a hand screw, and place the hinge piece on the board with the part to be sawed over the opening. Being careful to keep the saw blade in a vertical position, saw in the line.
10. Hold the two parts together by means of a 1″ wire nail, bevel the under side of the tenon, and chamfer the upper part of the hinge.
11. Prepare a piece $7'' \times 4\frac{1}{4}'' \times \frac{1}{4}''$; bevel the edges, and fasten the hinge in place by means of three $\frac{3}{4}''$ wire brads.
12. After the glass and picture are in place fasten in the back with four brads.

Analysis for marking: —

Dimensions, 36; joints, 20; hinge, 15; drilling, 5; finish, 24; total, 100.

MODEL No. 28.

PLANING TROUGH.

Material, $1\frac{7}{8}''$ and $\frac{7}{8}''$ pine wood; five No. 13 2″ wire brads; two No. 15 $1\frac{1}{2}''$ wire brads; and seven No. 18 $\frac{7}{8}''$ wire brads. Sawing dimensions, one piece, $20\frac{3}{8}'' \times 3\frac{1}{2}'' \times 1\frac{7}{8}''$; one piece, $20\frac{3}{8}'' \times 1\frac{5}{8}'' \times \frac{7}{8}''$; one piece, $18\frac{3}{8}'' \times 2\frac{3}{8}'' \times \frac{1}{2}''$. Planing dimensions, one piece, $20'' \times 3'' \times 1\frac{3}{4}''$; one piece, $20'' \times 1\frac{3}{8}'' \times \frac{3}{4}''$; one piece, $18'' \times 1\frac{3}{16}'' \times \frac{7}{16}''$; one piece, $18'' \times \frac{3}{4}'' \times \frac{7}{16}''$.

New exercises: —

In Bench Work. — Planing chamfers.

Order of Exercises.

1. Prepare a piece, 20″ x 3″ x $1\frac{3}{4}$″.
2. Gauge $1\frac{3}{8}$″ from the marked side on the marked edge and from the marked edge on the marked side.
3. Remove the corner by standing the piece upright in the vise and sawing just outside the lines. Plane to the lines, testing the surface with the bevel set at 135° and held close to the first side.
4. Make a piece 2″ long from the corner piece just removed.
5. Prepare a piece, 20″ x $1\frac{3}{8}$″ x $\frac{3}{4}$″.
6. Gauge $\frac{3}{16}$″, and chamfer the corner formed by the marked side and unmarked edge.
7. Glue and nail this piece in place, using five No. 13 2″ wire brads.
8. Glue and nail the triangular piece in place, using two No. 15 $1\frac{1}{2}$″ wire brads.
9. From the piece $18\frac{3}{8}$″ x $2\frac{3}{8}$″ x $\frac{1}{2}$″ prepare two pieces, one 18″ x $1\frac{3}{16}$″ x $\frac{7}{16}$″, the other 18″ x $\frac{3}{4}$″ x $\frac{7}{16}$″.
10. Gauge $\frac{5}{16}$″ on each piece, as in exercise No. 2 in this model.
11. Glue and nail the two pieces together, using seven No. 18 $\frac{7}{8}$″ wire brads.
12. Place the piece in the trough, and chamfer by planing to the lines.

Analysis for marking: —

Dimensions, 40; angles, 25; nailing, 14; chamfering, 9; finish, 12; total, 100.

MODEL No. 29.

TOWEL ROLLER.

Material, $1\frac{7}{8}$″, $\frac{7}{8}$″ and $\frac{1}{2}$″ pine wood; four No. 8 1″ screws. Sawing dimensions, one piece, 20″ x $5\frac{1}{4}$″ x $\frac{1}{2}$″; one piece, $19\frac{1}{4}$″ x 2″ x $1\frac{7}{8}$″; one piece, $4\frac{1}{2}$″ x $2\frac{1}{2}$″ x $\frac{7}{8}$″. Planing dimensions, one piece, $19\frac{3}{4}$″ x $5\frac{1}{8}$″ x $\frac{7}{16}$″; one piece, 19″ x $1\frac{3}{4}$″ x $1\frac{3}{4}$″; two pieces, 2″ x 2″ x $\frac{7}{8}$″.

New exercises: —

In Bench Work. — Cylindrical planing, veining and carving.

New tools: —

For Bench Work — Planing trough, veiner, skew chisel and wing calipers.

Order of Exercises.

1. From a $\frac{1}{2}$″ board saw a piece 20″ x $5\frac{1}{4}$″.
2. Make one side flat, joint one edge and block plane both ends, making it $19\frac{1}{4}$″ long.
3. Square a fine pencil line across the centre of the first side, and extend the line on an extra piece, on which find the centre for the larger curves
4. Draw the other construction lines with the gauge, try square and knife, and bore the $\frac{3}{4}$″ holes.
5. Remove the wood just outside of the lines with the turning saw, and finish with the chisel and spoke shave.
6. Make the lines with the veiner and do the carving with the skew chisel.

7. Gauge and plane the piece $\frac{7}{16}''$ thick.
8. Bore and countersink the holes for the screws for the brackets, and those through which the screws go that are to hold the model to the wall.
9. Prepare a piece, $19'' \times 1\frac{3}{4}'' \times 1\frac{3}{4}''$; draw a circle and octagon on each end.
10. On all four long surfaces gauge lines connecting corresponding corners of the octagons.
11. Place the planing trough in the vise, and with the piece resting in the trough plane to the lines.
12. Remove the next set of corners in the same way, and continue to do so until the circumference of the circles at the ends is reached.
13. Remove the remaining corners with the flat file and sand-paper.
14. At the centre of each end draw a circle $\frac{5}{8}''$ in diameter; from each end gauge $\frac{1}{2}''$ around the piece and deepen the line a little with the knife.
15. Saw with the back saw just outside the knife cuts about $\frac{1}{2}''$ deep.
16. Remove the wood to the lines with the chisel, and finish the dowels with file and sand-paper.
17. From the piece $4\frac{1}{2}'' \times 2\frac{1}{2}'' \times \frac{7}{8}''$ prepare two pieces, $2'' \times 2'' \times \frac{7}{8}''$.
18. Draw the construction on the pieces, and bore at the centre on one side of each a hole $\frac{5}{8}''$ wide and $\frac{1}{2}''$ deep.
19. On the left-hand bracket gauge lines from the sides of the hole to the end and halfway across the end.
20. Cut out the slot between the lines to the depth of $\frac{1}{2}''$ with chisels.
21. Clean all parts with fine sand-paper, and screw them together.

Analysis for marking: —

Dimensions, 24; curves, 12; roller, 15; carving, 15; boring, 8; dowel, 10; finish, 16; total, 100.

MODEL No. 30.

Level.

Material, $1\frac{7}{8}''$ pine, $\frac{1}{2}''$ black walnut, one small screw eye, $\frac{1}{16}''$ sheet brass. Sawing dimensions, one piece, $24\frac{1}{2}'' \times 4'' \times 1\frac{7}{8}''$; one piece, $12\frac{1}{2}'' \times 2'' \times 1\frac{7}{8}''$; one piece black walnut, $8'' \times \frac{1}{2}'' \times \frac{1}{2}''$. Planing dimensions, one piece, $24'' \times 1\frac{3}{4}'' \times 1\frac{3}{4}''$; three pieces, $12'' \times 1\frac{3}{4}'' \times 1\frac{3}{4}''$; one piece black walnut, $8'' \times \frac{3}{8}'' \times \frac{3}{8}''$.

New exercises: —

In Bench Work. — Making blind mortise and tenon joints at the ends of a brace and a square pyramid; brass filing and boring.

New tools:

For Bench Work. — Large steel square.

Order of Exercises.

1. Prepare one piece, $24'' \times 1\frac{3}{4}'' \times 1\frac{3}{4}''$; three pieces, $12'' \times 1\frac{3}{4}'' \times 1\frac{3}{4}''$.
2. Join one of the $12''$ pieces to the $24''$ piece by a blind mortise and tenon joint, making the tenon $1''$ long.

3. Lay out and cut the pyramid at the top end of the upright piece, using back saw and block plane.
4. Being careful to make all the gauge lines from the first side, lay out and cut the tenons at the ends of the braces. Cut $\frac{3}{8}''$ from the end of the upper tenons.
5. Place the base and upright piece together on the bench with the first side up.
6. Be sure that the upright piece is perpendicular to the base by testing with the large steel square.
7. Lay the braces in place with the sides of the tenons resting on the base and perpendicular, and indicate the exact position of each mortise by very fine pencil marks.
8. Lay out and cut the mortises.
9. Drawbore as in No. 23 for the dowels.
10. Make the dowel with the plane, using planing trough.
11. Mark the lines for the chamfers very lightly with the gauge, and chamfer with chisel.
12. Before the model is put together clean the edges of each piece.
13. Put the pieces together and drive the dowels in place.
14. Clean the sides.
15. At the centre of the base of the pyramid on the front side of the upright piece place a small screw eye; to this tie the plumb line.
16. Make a short vertical mark with the chisel in the centre of the front side of the base.
17. Cut from a piece of $\frac{1}{16}''$ sheet brass and file to shape a piece for the plumb.

Analysis for marking: —

Dimensions, 36; angles, 21; joints, 20; pyramid, 9; chamfering, 14; total, 100.

MODEL No. 31.

Whisk Broom Pocket and Cabinet Picture Frame.

Material, $1\frac{7}{8}''$ and $\frac{1}{2}''$ pine wood; four No. 14 $2\frac{1}{2}''$ screws; two $\frac{3}{8}''$ brass escutcheon pins. Sawing dimensions, one piece, $7\frac{1}{4}'' \times 3'' \times 1\frac{7}{8}''$; one piece, $12\frac{3}{4}'' \times 7\frac{1}{2}'' \times \frac{1}{2}''$; one piece, $7\frac{1}{4}'' \times 5\frac{1}{2}'' \times \frac{1}{2}''$. Planing dimensions, one piece, $12\frac{3}{4}'' \times 7\frac{1}{2}'' \times \frac{7}{16}''$; one piece, $7'' \times 5\frac{1}{8}'' \times \frac{7}{16}''$; two pieces, $7'' \times 1\frac{1}{4}'' \times 1\frac{3}{4}.''$

New exercises: —

In Bench Work. — Inside fret sawing, straight fluting and inside quarter fluting.

Order of Exercises.

1. From a $\frac{1}{2}''$ board prepare a piece $12\frac{3}{4}'' \times 7\frac{1}{2}'' \times \frac{7}{16}''$.
2. Draw a fine pencil line through the centre of the width the entire length of the piece; from this line draw the other construction lines.
3. Bore a $\frac{1}{4}''$ hole just inside of each end of the inner ellipse.

4. Through these holes place the fret saw blade, and saw with the grain just inside the line.
5. Finish to the line with the knife.
6. Gauge $\frac{1}{4}''$ from the first side around the inside of the opening.
7. Remove the wood from this line to the line forming the outer ellipse, using the gouge.
8. Place the piece in the vise horizontally, and bore the 1″ holes forming part of the outline.
9. Saw with the turning saw just outside of the remaining lines and finish with the spoke shave and chisel.
10. Vein the lines.
11. From the piece $7\frac{1}{4}'' \times 3'' \times 1\frac{7}{8}''$ prepare two pieces, $7'' \times 1\frac{1}{4}'' \times 1\frac{3}{4}''$.
12. Flute the grooves with the gouge, and make the rabbet with the rabbeting plane.
13. Prepare a piece, $7'' \times 5\frac{1}{8}'' \times \frac{7}{16}''$, bore and countersink the holes.
14. To this piece glue the two pieces, $7'' \times 1\frac{1}{4}'' \times 1\frac{3}{4}''$.
15. Drive an escutcheon pin $\frac{1}{4}''$ from the lower end of each rabbet.
16. Bore the four screw holes through the back.
17. Secure the two parts together by means of four No. 14 $2\frac{1}{2}''$ screws.

Analysis for marking: —

Dimensions, 24; outline, 16; inside ellipse, 12; quarter fluting, 12; veining, 16; rabbets, 10; half fluting, 10; total, 100.

Exercises in Wood Turning.

As supplementary to the foregoing course in wood-working may be suggested the exercises represented in the following plates (see Plates XIV. and XV.).

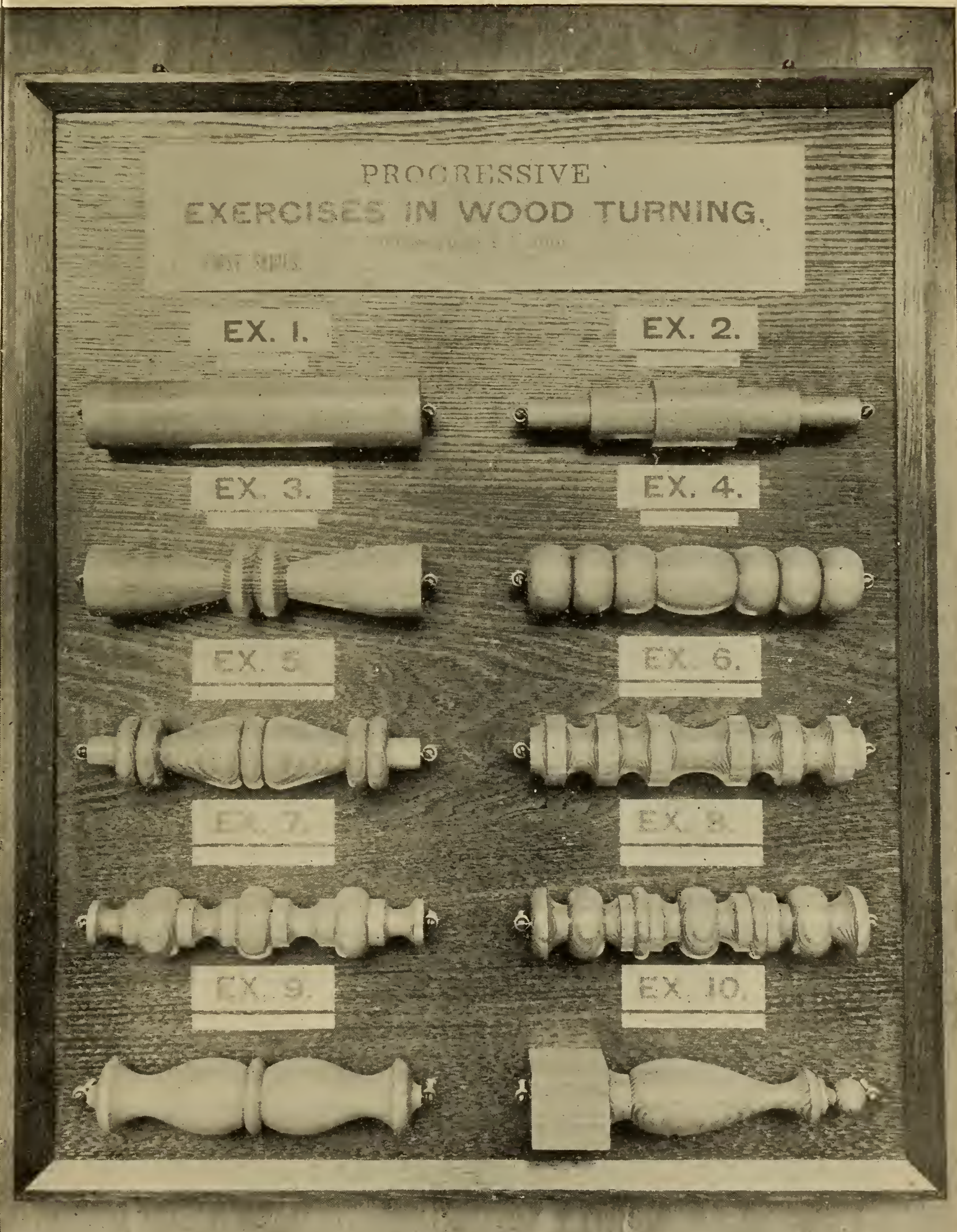

PROGRESSIVE
EXERCISES IN WOOD TURNING.
EX. 1.
EX. 2.
EX. 3.
EX. 4.
EX. 5
EX. 6.
EX. 7.
EX. 8.
EX. 9.
EX. 10.

Plate XIV.


Supplementary
EXERCISES IN WOOD TURNING.
ARRANGED BY B. F. EDDY.
FIRST SERIES.
EX. 2, A.
EX. 4, A.
EX. 4, B.
EX. 6, A.
EX. 8, B.
EX. 8, A.
EX. 10, A.
EX. 10, B.

Plate XV.

Appendix H.

THE NORTHAMPTON SYSTEM OF MANUAL TRAINING.

By FREDERIC A. HINCKLEY.

The purpose of this system is to supply at small expense manual training for primary and grammar grades which can be taught in the school-room, and if necessary by the regular teacher.

The projector, if he may so style himself, is indebted to Mr. George B. Kilbon of Springfield for the idea of using the jack-knife, and for the suggestion of utilizing the school-room for manual training work, also for help in certain practical details. He is indebted to Miss E. C. Elder, superintendent of free kindergartens in Buffalo, for the thought of adapting the system to primary grades and for much co-operation in evolving the line-cutting tablet work for those grades. Many of the other elements of the course, as will be easily seen, have been suggested to him by the study of processes already in existence. His attempt has been to produce, out of all the materials at hand, assisted by the kind co-operation of others, a logical, progressive American system, in keeping with public-school methods, and easily made a part of public-school administration. He has named it the "Northampton System," because that city has adopted it and made it a required part of her school work.

The tools needed at the beginning are pencil, rule and pocket knife. Afterward are added from time to time dividers, hammer, screw driver, gimlet, gauge and try square. At first the work is done on the school desk. With the introduction of the hammer a plain portable desk cover is provided, which transforms the desk to a simple work bench. Only such tools and materials are selected as are available in the ordinary school-room.

The system is only in its second year of practical administration here, and hence has not been graded throughout. The plan has

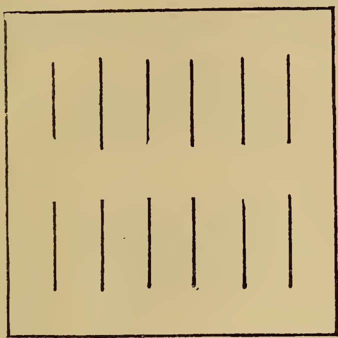
been to begin with the second year of school, and to continue the course to the graduation from the grammar grade, or the completion of the ninth year; thus practically bridging the chasm between the hand-work of the kindergarten and the advanced manual training shops of the high-school grade. Each room has two periods a week of thirty minutes each, that being the time given to other recitations. For the present all the grades begin at the beginning, thus securing ample time for permanent grading in the light of experience. The teachers meet with the projector once a week for an hour and a half, and easily become interested and proficient in the work, as do the children, and our special teacher of drawing now gives one-fourth of her time to its supervision.

So far as the use of the knife is concerned, the work is divided into three parts, — cutting of lines, cutting of surfaces, cutting of solids.

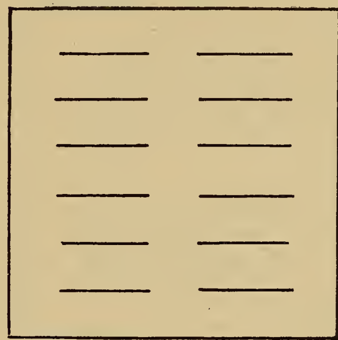
We did not in Northampton begin the work with the first year of the primary school, for two reasons: first, it was a fair question, and is, we think, still, whether the children in that grade are not too young to use the knife with precision; second, the tendency in all first-year primary work toward kindergarten methods, such as paper folding and card-board modelling, is really a very good preparation for the drawing and cutting on wood to follow.

I will now try to indicate as briefly as possible the general character of our eight-years course, as planned and in process of application. The second, third and fourth years of school — that is, the highest three grades of the primary school — are provided with line cutting. We have at present fifteen plates, covering eighty tablets, of this kind of instruction. I give a few illustrations, as hints of what this work is, because they are quite fundamental to an understanding of the course. The tablets used are of bass-wood, 3½ inches square and for border patterns 8 x 2 inches, and all ⅛ inch thick. *The lessons are dictated, not copied*, and drawn from measurement, before being cut. After whatever preliminary lessons in the use of rule and pencil which may be necessary have been given, the first tablet is furnished the pupil, and he is taught to know the grain of the wood, and to place the tablet for drawing purposes so that the grain will run from back to front of his desk. His first series of sixteen tablets, including, before he gets through with them, at least two of original designs, are limited to vertical and horizontal lines, first the elements, then combination of the elements, then designs made from the elements. For example, these cuts, drawn to a scale of ½ inch to the inch, will show the character of the work and suggest the sequence. Nos. 1 and 2 are the elements, vertical and horizontal lines; No.

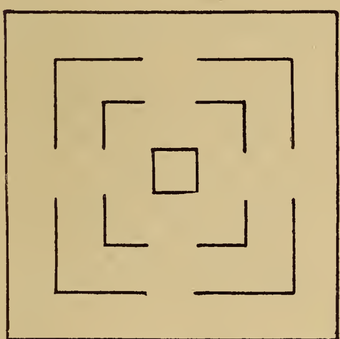
3, combination of the same; No. 4, a design; and No. 5, an historic border pattern.



1.



2.



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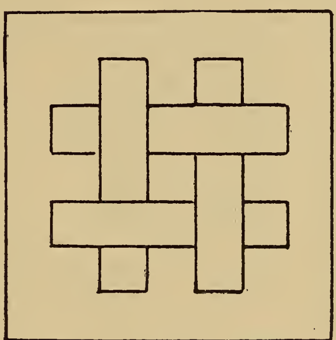

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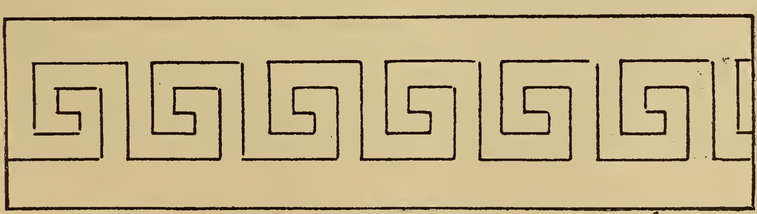
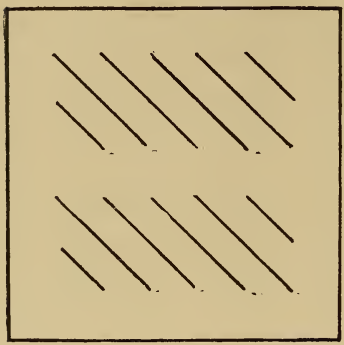


5.

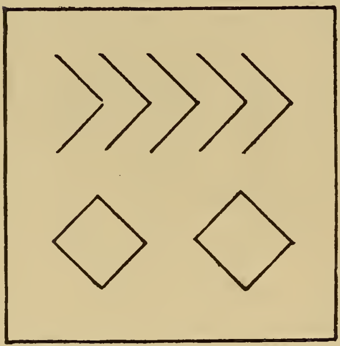
Having completed the series in vertical and horizontal lines, the next step is a series of sixteen in oblique lines. The following cuts will illustrate it sufficiently, again Nos. 1 and 2 being the

elements, No. 3 combination of the elements, No. 4 a design and No. 5 an historic border pattern.

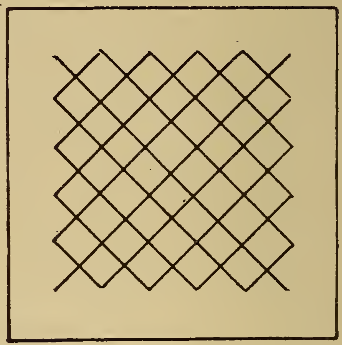


1.

2.



3.



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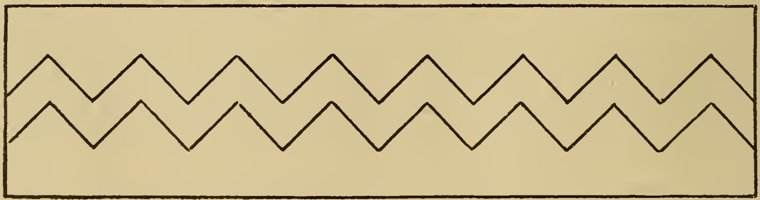
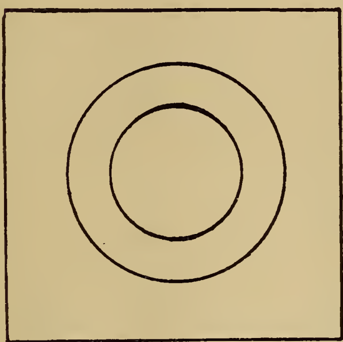


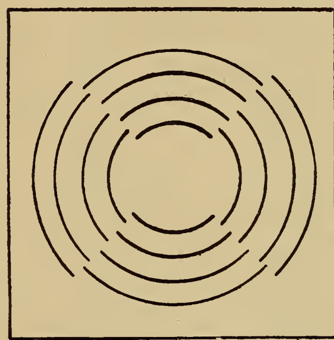
5.

Following the oblique lines come sixteen tablets, which are combinations of the vertical, horizontal and oblique; and then, with the introduction of a new tool, the dividers, come sixteen tablets

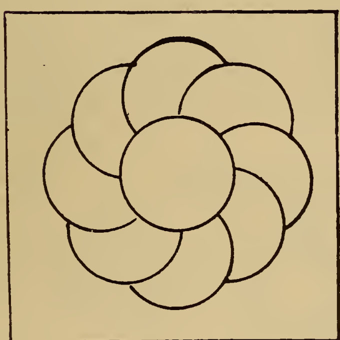
of curved lines, with elements, combination, design and border as before.



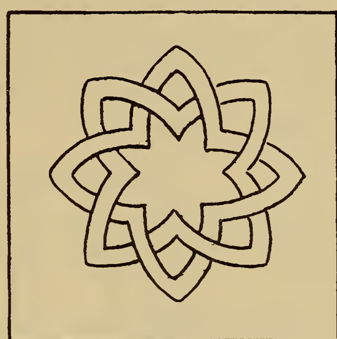
1.



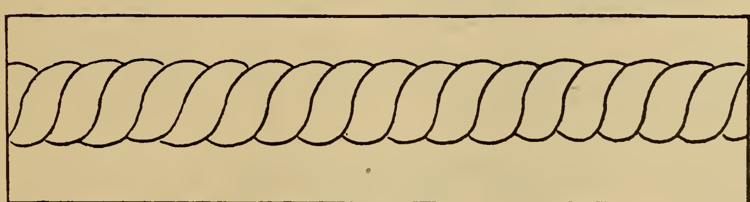
2.



3.



4.



5.

The line-cutting section of the system is now completed, with sixteen tablets which represent combinations of all the lines.

Now follows what we have called, by way of distinction, surface cutting. It consists, first, of cutting out in $\frac{1}{8}$ inch stock the square, triangle, pentagon, hexagon, octagon, circle, ellipse and oval ; second, of a series of crosses and various vase forms ; third,

of openings, vertical and horizontal, oblique, circular; fourth, in $\frac{1}{4}$ inch stock of small and cabinet-sized frame fronts with line ornamentation.

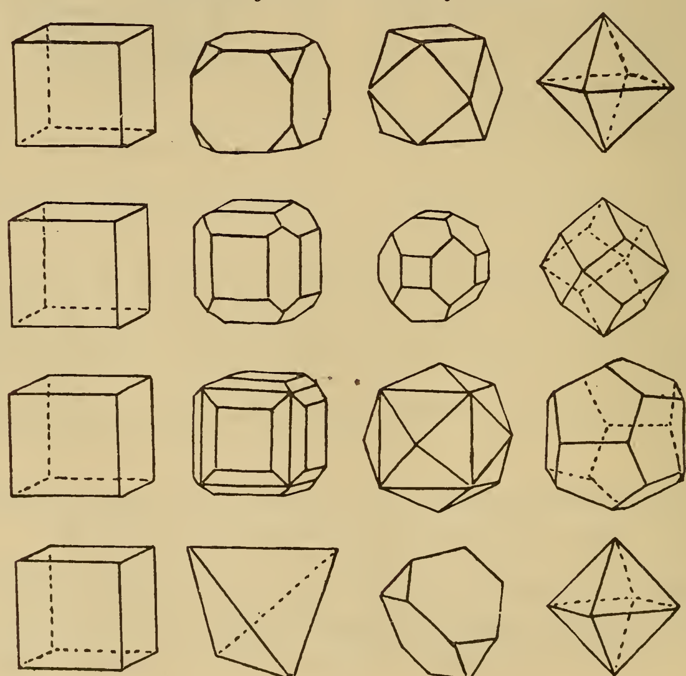
This brings us to the sixth year of school, when a series of problems with a small hammer and $\frac{3}{8}$ and $\frac{1}{2}$ inch No. 20 wire brads are introduced. First $\frac{1}{4}$ inch and afterwards $\frac{1}{8}$ inch stock is furnished, and ten problems in each thickness, passing from a simple joint to various kinds of boxes, performed. Then follow problems with screw driver and small screws, afterward the year being finished with a series of gimlet problems.

The seventh year welcomes two new tools, the gauge and try square. Now for the first time the planed stock is provided in pieces of convenient size, and the pupil, so far as it can be done with knife, gauge and try square, gets out his material. Plain and ornamental box and frame work is the task provided for this year.

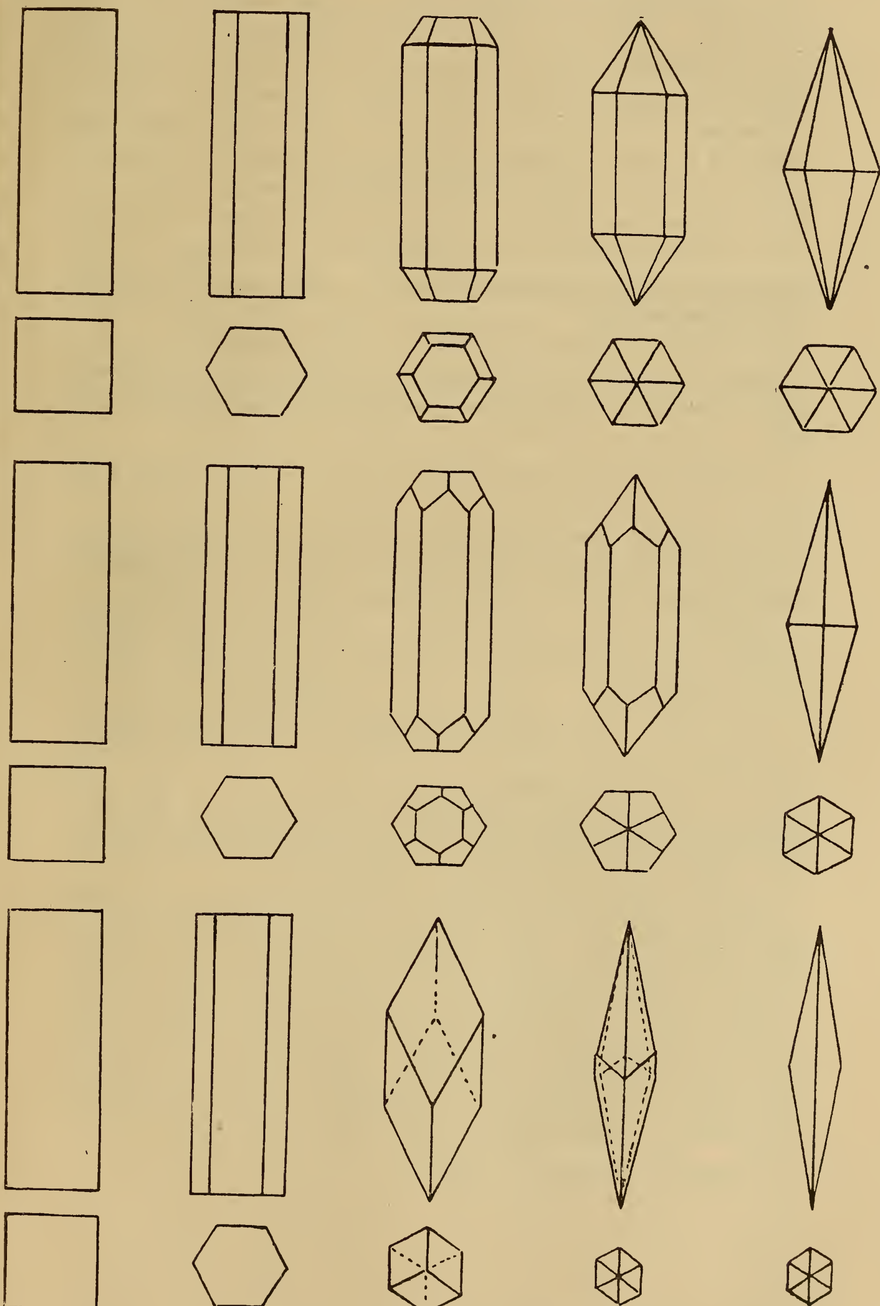
For the eighth year jointing and fitting problems are furnished, leading up gradually to lock-joint boxes, frames, etc.

The following illustrations will serve to suggest the form study and the evolution in work involved in the cutting of crystal models in the ninth year. The cuts are made to a scale of about $\frac{1}{2}$ inch to the inch.

Isometric System: the Cube furnished.



Hexagonal System: the Right Prism furnished.



The ninth year is chiefly devoted to the cutting of solids. Here the material, which up to this time has been bass-wood, is changed to soft pine. Cubes, $1\frac{1}{4}$ inches, are furnished, and from them are evolved through a series of four figures the cylinder, through a series of five figures the cone, and through a series of seven figures the sphere. In a similar manner from the right prism thus furnished is evolved through a series of six figures the ellipsoid, and from a thick square through a series of five figures the ring. Then follows the cutting of fifty odd crystal forms, representative of the six systems of crystallization, and designed to be accompanied with specimens, and more or less of study, of the crystals themselves.

We find our teachers and scholars, without distinction of sex, warmly interested in all the features of this work, and are already able to show very interesting and creditable original work on their part.

It is difficult to give any adequate idea of a system in the compass of an article like this, for the most part unillustrated.

I will give here what may prove of interest, the expense of one full set of tools, and a table showing the cost of our first year's experimental work in one of the school buildings in this city.

Expense of tools: pencil, $0.02; rule, $0.02; knife, $0.35; dividers, $0.08; hammer, $0.10; screw driver, $0.08; gimlet, $0.06; gauge, $0.12; try square, $0.17; total, $1.00.

Cost of first year's work in a building containing nine rooms, averaging fifty pupils each, or a total of four hundred and fifty pupils (time, two periods per week of thirty minutes each): 50 knives, at $0.35, $17.50; 100 pencils, at $0.02, $2.00; 50 rules, at $0.02, $1.00; 16,000 tablets, at $4.50 per thousand, $72.00; 1 set plates, entire course, $5.00; total, $97.50.

The above figures do not include, as will be observed, the teaching of the teachers. Where it can be afforded there may well be a special teacher; but there is nothing in the nature of the work to prevent its being administered, as is being done here, by the regular teachers, and in many ways it will prove helpful to them in general teaching and discipline. The whole system is now in such shape that the expense of equipping teachers accustomed to drawing and to dictating other lessons need not be large.

NORTHAMPTON, MASS., March 15, 1893.

Appendix I.

MANUAL TRAINING IN THE PUBLIC SCHOOLS OF FALL RIVER, WALTHAM, SALEM AND SPRINGFIELD.

B. M. C. Durfee High School, Fall River, Mass.

By WILLIAM CONNELL, Superintendent of Schools.

The manual training course forms one of the regular four-year courses of the B. M. C. Durfee High School, and consists of a combination of mathematics, sciences, modern languages, shop work and drawing.

The shop and drawing room are located on the ground floor of the high-school building.

The equipment of the shop is as follows: —

For Wood-working.

1. Twenty-one benches, each one supplied with a "quick-grip" patent vise, and four lockers to hold work and aprons. Tool drawers or closets are built in each bench.

Each bench is supplied with a set of hand-tools, as follows: fifteen-inch jack plane, eight-inch smooth plane, six-inch block plane, twenty-inch cross-cut saw, twenty-four-inch rip saw, ten-inch back saw, six chisels, three gouges, large and small try squares, screw driver, brace and bits, marking gauge, dividers, bevel, two-foot rule, brad awls, mallet, hammer, oil stone, oil can and bench brush. Several twenty-two-inch jointer planes, draw knives, large steel squares and straight edges are distributed among the benches, and a number of rasps, bits, compass saws, carving tools, matching and rebating planes, together with nails, screws, glue, sand-paper, etc., are supplied to classes as needed.

2. Twelve speed lathes, ten and one-fourth inch swing by twenty-two inches to twenty-four inches between centres are for wood turning. These lathes are mounted on benches, which are

built with drawers for holding tools, and closets for work and shop clothes. Each lathe is supplied with large and small face plates, screw chuck, spur and cone centres, long and short T rests, rule, calipers, mallet, four turner's gouges, three chisels, parting tool, boring tool and square-nose chisel.

3. Large band-saw machine, for cutting stock to convenient sizes and for practice in sawing curved forms.

For Iron Working.

Two fourteen-inch screw-cutting engine lathes, five-foot bed; two fourteen-inch plain engine lathes with five-foot bed; two thirteen-inch hand-lathes, with five-foot bed, for filing, polishing, etc.; one iron-planing machine, sixteen inches by fourteen inches, with five-and-one-half-foot bed; one emery grinder and one grindstone; twenty-seven feet of bench-room, provided with six Parker vises. Each engine lathe has a set of lathe tools, and there are chucks of various sizes, both universal and independent. For bench work there is an assortment of hammers, chisels, files, scratch awls, punches and dividers, and also sets of reamers, twist drills, arbors, taps and die plates, scales of various sizes and divisions, machinist's steel squares, levels, protractor, screw gauges, chuck drills and hand tools for metal turning. Power to drive the machines is furnished by a seven-and-a-half horse-power Sprague electric motor.

The course of work at present is as follows: —

Freshman Year.

Algebra, English, physiology and physical geography; shop work: bench exercises in wood. Divisions of two-foot rule; how to measure correctly and "lay off" dimensions with knife and pencil. Explanation of jack and smooth plane; how to sharpen, adjust and use the planes. Planing a true surface. Use of try square. Planing one side of stock "square" with face side. Use of marking gauge. Planing to gauge line, and to given dimension. Explanation of cross-cut and rip saw teeth. How to use the saw correctly. Sawing given length, across grain and with the object of sawing square with face side, each sawing being tested with try square to note inaccuracies. Sawing with back saw to knife line, as in joining. Use of block plane on end grain.

The planing and sawing exercises introduce the rule, dividers, marking gauge, bevel and try square, and separate exercises in the use of these "laying out" tools are given when necessary, to impress from the start the necessity of clean, accurate laying down of working lines. The class then learns to construct, on a smooth

piece of wood, angles of 90°, 60°, 30°, 45°, 15° and 75°, and the "angle board" is used in performing succeeding exercises when bevel lines are required. A square frame is next made, which gives practice in sawing the half-lap joints with back saw, and shows the importance of each stroke when several pieces are to form a whole.

As an application of planing and sawing exercises, a "mitre box" is made, and its accuracy tested by sawing in it the joints for a mitred frame. Then follows an exercise in boring holes square with face side of block, chamfering edges with block plane, paring with chisels, producing a semi-circular end from square end of board, chamfers of various shapes with chisel, cutting flutings with gouges, making gain joints, square and oblique halvings, mortise and tenon joints, as through, blind, open, relish, rafter, keyed and dovetailing. A piece of framework combining several of these joints is next made, and the course is completed by making a finished article, as a blacking box or bookcase, which serves to apply the different principles and processes of the year's work to a piece of construction.

Every exercise is made from a scale blue print, and the class is kept together on the same exercise, so that work progresses systematically. The freshman class has four periods of fifty minutes each per week.

Sophomore Year.

Plane geometry, English, botany and zoölogy; shop work; mechanical drawing. The shop work is wood turning. Names of parts of speed lathe, and manipulation in using and mounting work for turning. Straight cylinders with gouge, finishing cut with skew chisel. Difference between scraping and cutting. Convex curve. Concave curve. Reverse curve. Square shoulder. Taper cylinder. Rounding square corner. Beading. Balls. Scallops. Fitting plug to holes of various diameters; combinations of these elemental forms in turning a baluster, post and a spindle, which introduces duplication of shapes on each side of a centre. Face plate and chuck work, rosette, hollow stepped cylinder, box and cover, goblet, napkin ring, and piece of construction in the form of a wall towel rack and small centre stand, which apply nearly all of the principles and processes of the year's work.

The work is done entirely from blue prints, and conducted as class work.

The mechanical drawing of this year consists of: a sheet to acquire use of instruments in drawing horizontal, vertical and

oblique lines, intersecting with clean-cut junctions, circles and compound lines formed of tangent straight and circular lines and of tangent circular arcs ; three sheets of geometrical constructions, which are given mainly for practice in accurate lining and compass work ; a sheet of shade-lining examples.

The theory of orthographic projections is explained by lectures and studied by the aid of paper planes, and eight or nine sheets are drawn, solving problems regarding the rectangular, triangular and hexagonal prism and pyramid, the cylinder and the cone, with oblique projections, development and intersections of same and sectional views. Isometric drawing is then taken up, and one or two sheets, illustrating the application of projections to simple parts of machines, are drawn, some detail of such object being put into isometric.

The equipment for drawing consists of sixteen drawing trestles, with drawer and racks on the sides to hold boards ; T squares and boards, triangles, scales ; dividers with pen, pencil and needle point ; spring-bow pencils and bow pens, ruling pens, etc., sufficient for sixteen boys in a class.

The sophomores work four periods of fifty minutes each per week in the shop, and the same length of time in drawing room.

Junior Year.

Solid geometry and trigonometry, French or German, physics, shop work, mechanical drawing. The shop work of this year is work in metal, and consists of the following exercises : study of construction and manipulation of engine lathe and planing machine.

1. Turning straight cylinder, introducing centring, centre drilling, countersinking, squaring ends, roughing and finishing cuts, calipering, and filing and polishing in speed lathe.

2. Stepped cylinder, additional practice in turning to size and squaring shoulders.

3. Taper turning, and hand-tooling curves.

4. Screw cutting, right and left hand thread on ends of same stock piece.

5. Fitting bolt to hole in a collar, which has first been twist drilled and reamed to given size, and then turned on an arbor to size and shape of drawing.

6. Cutting thread of standard size on bolt, fitting nut to same, first tapping the nut, and filing to hexagon shape the bolt head and the nut, and polishing the same.

7. "Chucking" a five and one-half inch pulley, chuck drilling the hub, turning rim and hub to size and filing.

8. Making a ball handle, introducing the roughing out of curves in engine lathe, free-hand, and the hand-tooling of same to a finish in speed lathe; the fitting of two parts of handle by die stock and tap.

9. Cutting outside and inside V thread on one end of plug and cap, and outside and inside square thread on other end of plug and ring; boring tool.

10. Planing-machine exercise: planing block square all over, planing out square groove, planing out 45° V groove.

11. Chipping and filing bevel-edge, chipping and filing a rectangular hole from bored hole.

12. Construction of a jack screw.

All work is done from blue prints. While it is not possible to keep the class together, or take up these exercises always in order named, instructions are given to the class as a whole, and notes are taken down, so that the instruction may be as much systematized as possible. Much individual instruction and help must of course be given where such slight differences of shape and adjustment of tools cause such different results.

The drawing of this year consists in making working drawings of details of machines. Free-hand sketches are made first, and dimensioned, and these sketches are worked up into scale drawings with dimensions. The subjects are drawn partly from the object, partly from sketches and explanations of the instructor. Among the drawings thus executed may be mentioned gear blank, split pulley, bolts and screw threads, eccentric and strap, connecting rod with all details drawn separately, from which the class were to construct, without help, an assembly drawing, head stock, tail stock, etc. The drawings are made to various scales, and sections are drawn, and one view obtained from others given, to test the ability of the pupil to grasp clearly the correct appearance of the object which he is representing.

The juniors work in shop four periods of fifty minutes each per week, and in drawing room three periods of fifty minutes each per week.

Senior Year.

Chemistry, English, French or German, shop work, drawing. The shop work and drawing of this year consist at present of the designing, drawing and construction of an article of cabinet work. This work is made original as far as possible, and is intended to give some chance for individual judgment in shaping and sizing of parts, and in joining together of various portions of a finished article. Among the projects thus made may be mentioned writing desks, tables, cabinet book case, hall stand, coin cabinet, etc.

The drawing of this year consists, first, of the making of the necessary drawing for the before-mentioned cabinet project, and after that some finished drawing of a machine or engine is made, this being determined by the amount of time available.

The senior class works four periods a week in shop, and in drawing room two periods a week.

School at Waltham, Mass.

By WM. F. JARVIS, Chairman Committee on Manual Training.

Waltham, Mass., April 12, 1893.

Edwin P. Seaver.

Dear Sir : — Yours of March 31 to Mr. Whittemore has been referred to me for reply.

Our present system of manual training was established in 1891, and is a modification of sloyd. Pupils are admitted from the seventh, eighth and ninth grades of the grammar school, and the first two years of the high school, the latter being a special course provided for this department.

We have a regular graded system for the manual work, commencing with simple forms of models, progressing through those more difficult, including exercises in wood turning, carving and pattern making, to iron work (forging, welding, tempering and chipping and filing). Each exercise is embodied in a model that is more or less familiar to the pupil, there being no purely exercise work upon abstract forms. By this means pupils get continuous review work, as the advanced models combine a variety of old with new exercises. Each model is made from a drawing done by the pupil, at present under the direction of the instructor of manual training, except those in the iron department, which are made from blue prints. It is intended that the models shall occupy the time of the pupils for five years, working according to the present schedule, which is as follows: boys of the seventh and eighth grades work one period of two hours a week; those of the ninth grade, two periods of two hours each a week. The high school class work two hours a day. Below is the curriculum of this department: —

First and Second Years.

Seventh and eighth grades, — one period a week. Elementary work in wood: marking, sawing, squaring, nailing, filing, chiselling, gluing, sand-papering, etc. Uses of tools; drawing.

Third Year.

Ninth grade, — two periods a week. Advanced work in wood: boring, planing, bevelling, carving, grooving, dovetailing, drawing.

Fourth Year.

First Half. — High school, — two hours a day. Academic studies: English, three times a week; geometry, four times a week; physics, four times a week; drawing. Manual work: joint making, wood turning, staining, varnishing, grinding of tools, lectures on woods.

Second Half. — Academic studies: English, three times a week; civics, four times a week; physics, four times a week; drawing. Manual work: scraping and polishing, carving, saw filing, lectures on woods and their uses, chipping and filing metals.

Fifth Year.

First Half. — High school, — two hours a day. Academic studies: English, three times a week; algebra, four times a week; geometry, four times a week; chemistry, four times a week; drawing. Manual work: advanced wood-working, forging, welding and tempering, soldering and brazing, lectures on metals and their uses.

Second Half. — Academic studies: English, three times a week; algebra, four times a week; geometry, four times a week; drawing. Manual work: pattern making, drilling and chipping and filing of metals.

The classes are formed at the beginning of the year from volunteers, but, having joined a class, the pupil is required to give regular attendance. A class of girls from the high school was formed last September, and much interest is manifested by them. The whole number of pupils in this school is one hundred and fifty-nine; the per cent. of attendance is ninety-four.

The equipment for the work of the three grammar grades is as follows: twenty-four benches, each of which is supplied with a knife, try square, marking gauge, wooden mallet, twenty-four inch rule, a smoothing and block plane and pencil. In addition to these tools a case is provided in the room containing every other tool that may be required in the work, to be used in common by the pupils. Inasmuch as the different classes come at different times, each bench is used by six or seven boys in the course of a

week, but each boy is responsible for the condition of his bench and tools when he has finished his day's work. Two hundred closed lockers are provided, to enable the boys to keep their unfinished work and the drawings in a neat condition.

The cost of the foregoing is: for twenty-four benches, $312; tools, $150; lockers, $150; tool cabinet, $25; total, $637.

For the work in the advanced department there are provided: fifteen benches, at a cost of $195; five speed lathes, $375; one-fifth horse-power electric motor, $325; four forges, $60; four anvils, $48; ten vises, $60; tools, $250; total, $1,313.

The cost of maintaining the school, with two instructors, is about $2,500 per annum.

Boys are required to provide themselves with a uniform working suit, and to conduct themselves upon general principles of good order.

Benches and suitable tools for carving are among the equipment, as well as tool rooms and model rooms in each department.

School at Salem, Mass.

By W. A. MOWRY, Superintendent of Schools.

Salem, April 6, 1893.

Edwin P. Seaver, *Superintendent of Schools, Boston.*

My Dear Sir: — In reply to yours of the 3d I beg to say, — Salem has for some time past given a minimum of attention to the subject of manual training in connection with her public schools. She has: —

1. *The Curwen Manual Training School*, for instruction in the use of tools in wood-working. The course is for one year, and the pupils are from the grammar schools. There are ten classes of twelve boys each. They all have one lesson — a half day's session — per week.

2. *The Cooking School*, for girls. This gives instruction in cooking to five classes of sixteen each, a half-day lesson each week. These pupils are from the upper grades of the grammar schools.

3. During the winter, November till March, the *evening drawing schools* (one for free-hand and one for mechanical drawing). These schools are principally for those outside of the day schools.

4. Drawing in the public day schools.

This is as far as the city has gone in manual training, and I see no disposition to go further at present.

Springfield Manual Training School.

By GEORGE B. KILBON, Principal.

What has been Done.

In 1886 an appropriation of $1,000 was made, for an experiment; $500 of it was expended in purchasing an equipment of twelve sets of tools, and the remaining $500 in salary, the school sessions continuing as long as the money lasted. Since then the appropriations have been made as follows: in 1887, $3,000; in 1888, $3,000; in 1889, $4,000; in 1890, $4,000; in 1891, $4,500; in 1892, $4,500. Of these sums, an average of $500 has been expended yearly in making additions to the equipment, which is now valued at $3,500, and consists of eighteen wood-working benches and tools, twelve wood-turning lathes and tools, three grindstones, one scroll saw, twelve molding troughs and tools, five forges, and tools with blower and exhauster large enough for twelve two-engine lathes, one planer, one drill press, seven vises for iron filing, with tools and a fifteen horse-power electromotor.

The room occupied is the first floor and the basement of a building forty-seven feet by seventy-three feet; three teachers are employed.

The work is organized in two departments; namely, high school and senior grammar. A three-years course is provided for the high school, consisting of one and a half hours' lessons each afternoon in joinery, wood turning, carving, pattern making, molding and plaster casting, forging, iron filing, planing and turning, and machine building. During the three years the students receive drawing lessons three-quarters of an hour each forenoon. The work is voluntary, and students are admitted from all high-school courses.

In the senior grammar department lessons are given (at the manual training building) to the ninth grade one and a half hours each week in the forenoon, and to the eighth grade one and a half hours each fortnight, from 4.30 to 6, afternoons. These lessons are in elementary wood-work, on the American system of problems in the beginning, followed by the making of articles. All articles regularly made are previously drawn at the ordinary school-room under the direction of the drawing supervisor. Various articles of equipment needed in the school have also been made by the pupils.

Manual training is also provided for grades six and seven by means of knife work. This is done in the ordinary school-room and by the ordinary teacher, desks being protected by removable covers. Lessons are three-quarters of an hour each week.

Teachers prepare themselves by attending the manual training school one and a half hours each week.

The manual training of the primary grades I., II. and III. consists of clay modelling, paper folding, sewing on pricked cards, and cutting and pasting colored papers to illustrate principles of design.

Construction in card-board commences in grade III., and is continued through grade VII., as is the making of designs in colored paper.

Girls have sewing in grades IV., V., VI. and VII., and cooking in grade VII. The sewing in grades IV., V. and VI. is in the form of elementary problems ; in grade VII. it is in garment making. Girls measure a model figure, draw the patterns and cut them, then from the patterns cut garments and make them.

What is Proposed.

For boys, a continual system of manual training from the first school year to and through the third high-school year, consisting of clay modelling, paper cutting and construction in card-board, using the rule with accuracy, in the first four years and onward ; knife work in the fifth, sixth and seventh years ; elementary woodwork with a full complement of tools in the eighth and ninth years ; and an extension of the room and equipment at the manual training school sufficient to give lessons to classes of twenty in the above-mentioned high-school branches, coupled with a recognition of manual training as a part of the regular high-school work.

For girls, a continuous system, as for boys, in clay modelling, paper cutting and card-board construction ; with sewing from grades V. to VII., and cooking in grades VII. and VIII. and in the high-school junior year. The high-school cooking will be in connection with physics and chemistry.

A pamphlet, published by the school committee of Springfield, and giving a full account of the Springfield Manual Training School, its equipment and its exercises, is here reprinted, with the omission of some portions not necessary to our present purpose. — *The Commissioners.*

A course of weekly lessons covering one year has been established for the ninth grammar grade, and a course of daily lessons covering three years for the high school.

Six classes have been organized this year from eighth grammar grades, averaging fifteen pupils to each class. Three of these classes receive lessons Monday, Tuesday and Thursday of one week, from 4.30 to 5.45 P.M., and the remaining three classes on the following week, providing one lesson a fortnight for each class. Their lessons are the same as those hitherto given to the ninth grade.

On Wednesday of each week, at the above hour, a class of high-school girls receive a lesson in general tool work, and on Friday a class of teachers in knife work.

Knife Work.

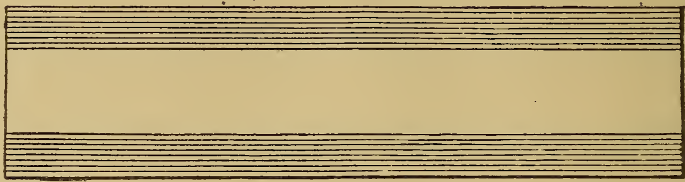
For four years there has been an interesting experiment in knife work in progress at the Hooker Grammar School in grades five to seven, inclusive, and during the last two years at the Tapley School. Teachers who give this instruction take lessons preparatory thereto at the Manual Training School.

The knife is the only cutting tool used. Problems for this work were arranged by the principal of the Manual Training School, and those for the fifth grade, which are chiefly geometric forms cut from thin wood, appear in the cuts immediately following.

Minute descriptions regarding their construction are published by the Milton Bradley Company of this city, who also supply the material.

The work is done in the ordinary school-room on the ordinary school desks, which are protected from injury by a temporary cover of one-half inch pine.

Knife Work.



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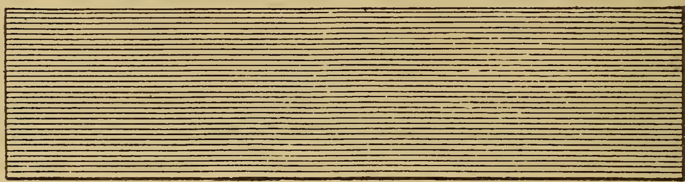

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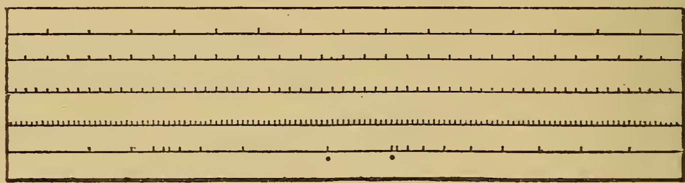

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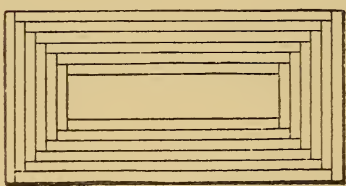

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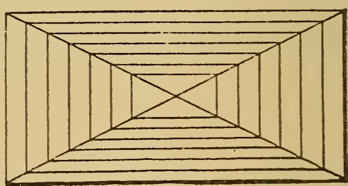

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Knife Work.


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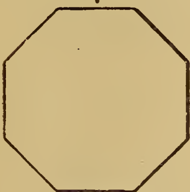
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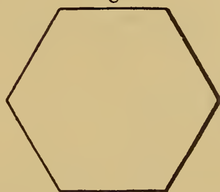
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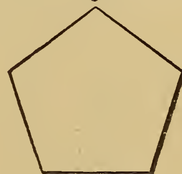
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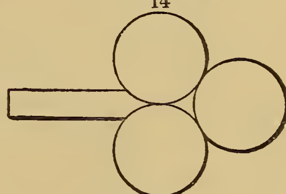
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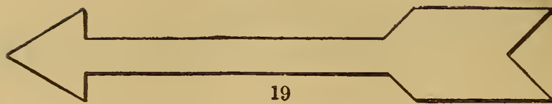
Knife Work.



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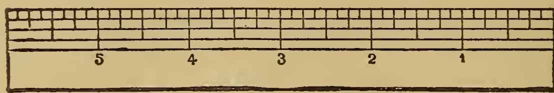

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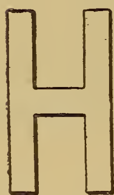

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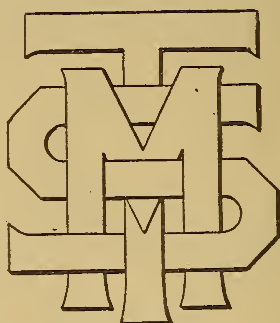

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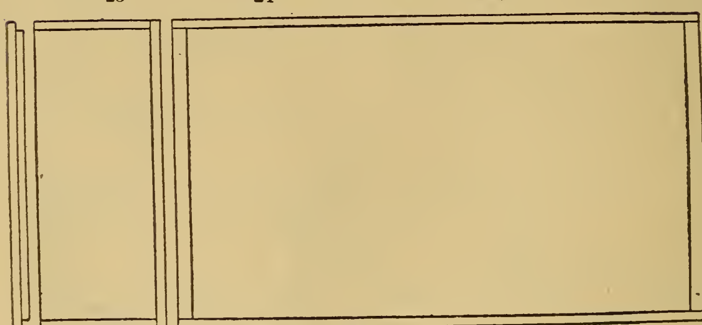

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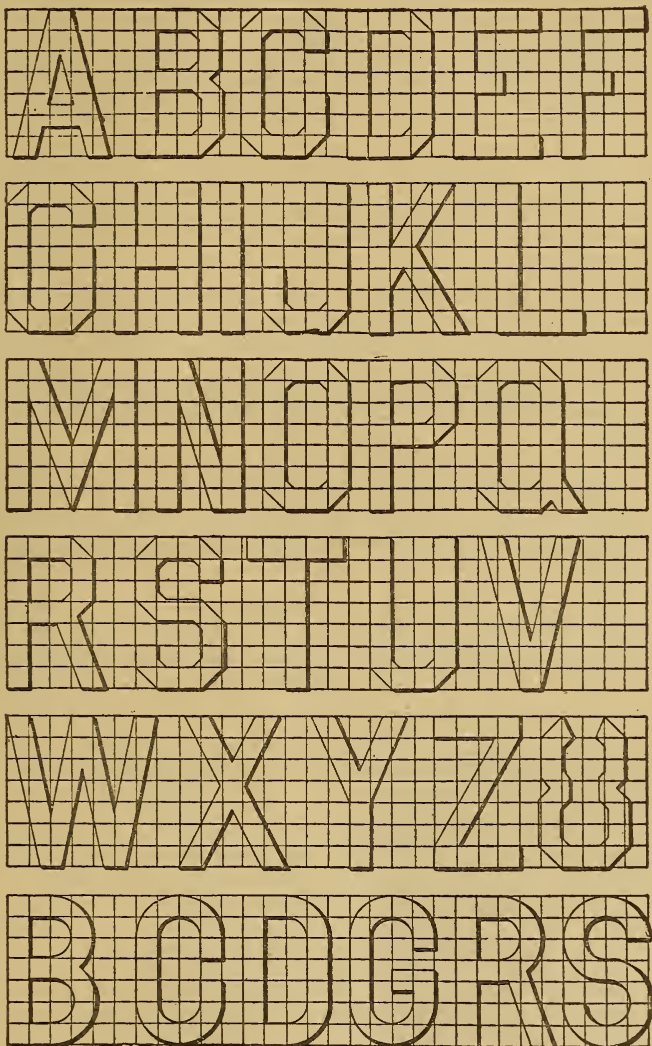
Knife Work.



Equipment.

The wood-working equipment of the Manual Training School consists of eighteen benches, eighteen sets of tools, three hundred and fifty-two drawers for holding work and forty drawers for holding prepared material, costing $750. Also, twelve wood-turning lathes, costing $600; three grindstones, costing $50; the necessary shafting, pulleys and belts, $150.

The school is also furnished with twenty-four sets of carving tools, each set being arranged in a portable tray, and with a cabinet to hold the trays. Cost of carving equipments, $205. Its moulding equipment consists of twelve troughs and tools, costing $215. Calcined plaster is used for pouring.

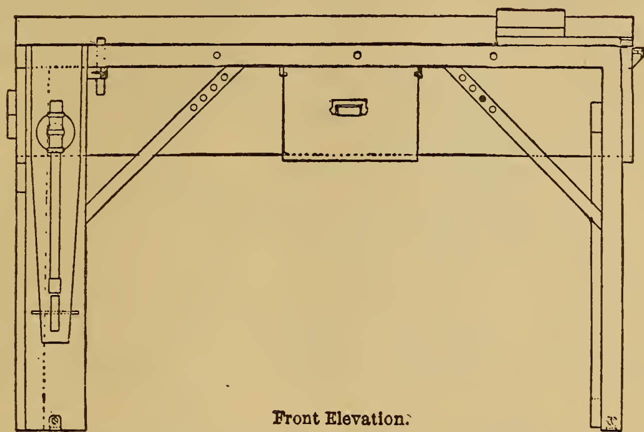
The iron equipment consists of two engine lathes, one planer, one drill press, one forge, four iron vises and tools, costing $1,600. The six horse-power Shipman engine which has hitherto furnished power for the school was exchanged in December, 1891, for a fifteen horse-power electromotor, manufactured by the Elektron Manufacturing Company of this city.

The benches for wood-working are 4½ ft. long x 2 ft. wide x 34 in. high. Pupils of small stature are accommodated by movable platforms. The bench tops should be two or three inches above the wrist when the pupil stands erect. Benches are arranged in rows about three feet apart each way.

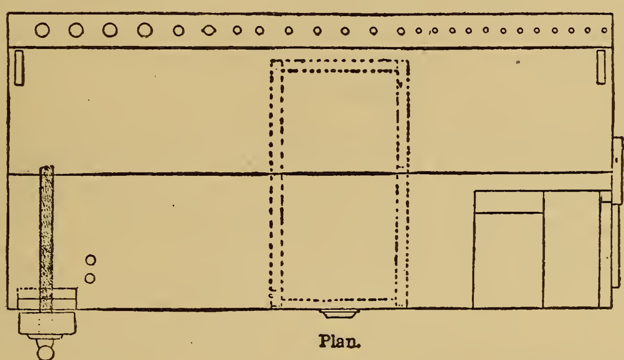
The following is a list of tools with which each bench is supplied: bevel, 6 in; bit brace; bits, auger, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{3}{4}$ in.; bits, drill, $\frac{5}{32}$, $\frac{7}{32}$ in.; brad awls in handle; chisels, firmer, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1 in.; countersink; dividers with pencil; gauge; gouge, $\frac{1}{2}$ in. inside, ground; gouge, $\frac{3}{4}$ in. outside, ground; hammer, claw; hammer, peen; hand screw, 10 in.; knife with two blades; mallet; oil stone; oil can; one lead pencil, medium; one very hard; plane, the Bailey iron smooth, 8 in.; plane, the Bailey iron block, 6 in.; plane, wood smooth, 8 in.; pliers; rule, 12 in., solid boxwood; saw, 16 in., panel, slitting; saw, 16 in., panel, cutting-off; saw, 10 in., back; saw block; screw driver, 3 in.; try square, 4 in.; dust pan; broom for floor; brush for bench top; whisk broom for clothing.

The school is further supplied with eight 22 in. iron Bailey jointers, six framing squares, and two 26 in. hand saws.

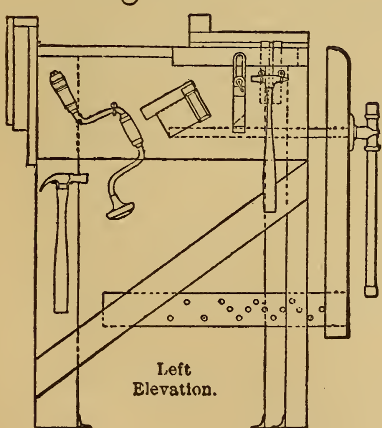
Each bench is provided with a vise at the left-hand end, and a shove-plane block at the right. (See figures following.) On or about each bench a place is provided for each tool (see right and left elevations, next page, on which the tools there kept are shown in position). The phototypes from which these figures are printed were produced from scale drawings of the bench made by pupils, and are one-sixteenth of full size.



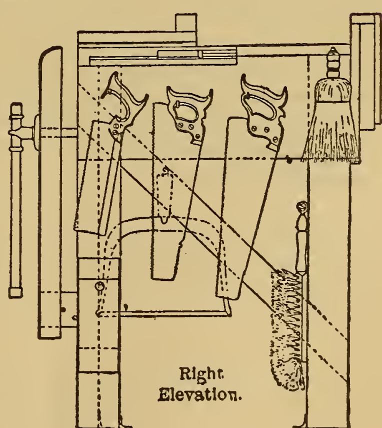
Front Elevation.



Plan.



Left Elevation.



Right Elevation.

The three hundred and fifty-two drawers are each 21 in. long x 10 in. wide x $7\frac{1}{2}$ in. deep, inside measure, and are inclosed in cupboards, each 6 ft. high x 4 ft. 5 in. wide x 2 ft. deep, each cupboard containing thirty-two drawers. Each pupil has a drawer for his exclusive use.

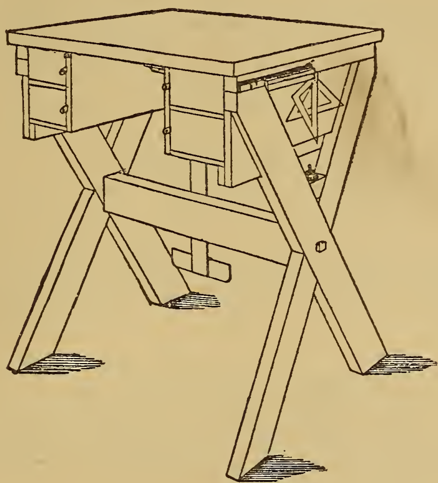
Pupils work in classes not exceeding eighteen, one and one-half hours constituting a lesson.

The twelve lathes for wood-turning are 9 in. swing, six of them $3\frac{1}{2}$ ft. bed and six 4 ft. bed, and were made by F. E. Reed of Worcester, Mass. Each lathe is provided with head and tail centres, screw face plate 4 in. diameter, plain face plate 6 in. diameter, 5 in. rest, 10 in. rest, oiler, oil stone, slip stone and the following tools: 1 in. gouge, ground straight across the end, for roughing; $\frac{3}{4}$ in. gouge, round end; $\frac{3}{8}$ in. gouge, round end; 1 in. chisel, skew edge; $\frac{3}{4}$ in. chisel, round edge; $\frac{3}{8}$ in. chisel, skew edge; $\frac{1}{2}$ in. chisel, straight edge; $\frac{1}{8}$ in. chisel, for parting; mallet; 10 in. calipers; 7 in. dividers; rule and lead pencil; dust brush and pan.

The carving equipment of twenty-four sets was purchased of White, Van Glahn & Co., New York, and Goodnow & Wightman, Boston. It comprises seventeen tools in each set, designated in J. B. Addis' catalogue as follows: $\frac{1}{2}$ in., No. 1; $\frac{1}{4}$ in., No. 1; $\frac{3}{8}$ in., No. 2; $\frac{3}{4}$ in., No. 3; $\frac{3}{4}$ in., No. 4; $\frac{5}{8}$ in., No. 5; $\frac{7}{16}$ in., No. 5; $\frac{1}{2}$ in., No. 7; $\frac{1}{8}$ in., No. 7; $\frac{7}{16}$ in., No. 9; $\frac{3}{8}$ in., No. 9; $\frac{3}{16}$ in., No. 9; $\frac{1}{4}$ in., No. 11; $\frac{1}{8}$ in., No. 11; $\frac{3}{32}$ in., No. 11; $\frac{1}{4}$ in., No. 39; $\frac{1}{8}$ in., No. 39. Also a pencil gauge, and two stamps, one $\frac{1}{4}$ in. square, and one $\frac{1}{8}$ x $\frac{3}{8}$ in., both of which were made by the pupils. Pupils also made octagonal handles for the above tools.

The drawing room is supplied with twenty-four wooden tables of original design, twenty-four T squares, twenty-four pairs of triangles, fifty drawing boards, with a rack to hold them, and a case of trays to store drawings, also of original design. Pupils furnish their own drawing instruments. Each table is 36 in. high, the dimensions of the top being 34 in. x 22 in., and is provided with four drawers, 14 in. x $6\frac{1}{2}$ x $3\frac{1}{4}$, inside measure, each drawer having a metallic projection or staple on the side, corresponding when the drawer is closed to a like projection on the side of its pocket, so that the hasp of a small padlock may be thrust through the staples, thus enabling pupils who wish to secure each his own instruments.

The following is a perspective view of one of the drawing tables, the cost being $7.50 each: —



The study of practical mechanics closely resembles that of arithmetic. As it is necessary in arithmetic first to learn to write numbers (notation), so in mechanics it is necessary first to learn to write forms (drawing). As in arithmetic, so in mechanics, there are four fundamental rules that must be thoroughly understood and constantly practised. They are as follows: —

Rule First. — Measure accurately, according to plan.

Rule Second. — Make perfect lines.

Rule Third. —With rapid-cutting tools, work as near to lines as can be done with safety.

Rule Fourth. — With fine-cutting tools, work exactly to lines.

It will be seen from the above rules that accuracy of result is equally necessary in both studies. If the result of an arithmetical problem is 145, any other result is incorrect, however small the fraction of variation; and, if a board is required to be made 6 in. long x $2\frac{1}{2}$ in. wide, the result is not correct if it varies at all from that measurement.

In the Springfield Manual Training School it has been deemed wise to give to grammar pupils an elementary course, which covers the use of each class of tools in the set, and which trains in accordance with the above rules. This course is as follows: —

Elementary Course in the Use of Wood-working Tools.

(*Designed for Beginners.*)

As each tool is taken in hand, describe it thoroughly and name its parts.

Prepare six wall-plates, 19 in. x 25 in., showing position of hands in holding hammer, try square, gauge, saw and chisel, and position of nails in boxes.

Lesson I.— Use of the Hammer.

Problem 1. — Provide for each pupil a block of pine 8 in. x $1\frac{7}{8}$ in. x $1\frac{7}{8}$ in. On one side draw three pencil lines lengthwise, dividing the block in four equal spaces. Place points on each line at every inch, and on one line drive a row of 6*d.* steel wire nails, leaving the heads standing $\frac{3}{4}$ in. above the wood. (See wall-plate for position of hand in holding hammer)

Problem 2. — Draw the above driven nails.

Problem 3. — In a similar manner drive a row of 6*d.* cut nails on a second line, and draw them

Problem 4 — On a line $\frac{1}{4}$ in. from the edge of the block, drive a row of 1 in. No. 18 steel wire nails, having their points bent so the nails will curve and come out on the adjacent side, meeting a line drawn $\frac{1}{2}$ in. from the edge

Problem 5. — Take a piece 2 x 2 x $\frac{7}{8}$ for a base, and a piece 2 x $\frac{7}{8}$ x $\frac{7}{8}$ for a stud, and toe-nail stud to corner of base, using $\frac{5}{8}$ in. patent brads.

Problem 6. — Take two pieces 4 in. x $\frac{5}{8}$ in. x $\frac{5}{16}$ in. and nail them to the edge of a board 4 in. x 2 in. x $\frac{5}{16}$ in., and let them represent joists. Furnish floor boards $\frac{3}{4}$ in. wide x $\frac{1}{4}$ in. thick x 4 in. long, and teach blind-nailing with $\frac{5}{8}$ patent brads.

Problem 7. — Take prepared pieces of wood $\frac{1}{8}$ in. thick, and nail up a box 4 in. long x 2 in. wide x 1 in. high outside measure, taking care that no nails appear in the sides, and that the pieces are smoothly joined. Use $\frac{1}{2}$ in No. 21 steel wire nails. (See wall-plate for number and position of nails.) Mark places for nails right distance from edge of board by means of dividers, setting them to half the thickness of stock.

(Write name legibly on every piece of finished work.)

Lesson II.— Measurement.

Problem. — Take a piece 8 x $\frac{7}{8}$ x $\frac{7}{8}$; scribe with dividers a line $\frac{1}{8}$ in. from the edge on each face. Lay the rule along this line and mark with knife point at every $\frac{1}{2}$ in. Repeat on an adjacent side, marking at every $\frac{1}{4}$ in. Repeat on third side at every $\frac{1}{8}$ in and on the fourth side at every $\frac{1}{16}$ in. of alternate inches.

Lesson III.— Try Square.

Problem 1. — Take a piece 8 x $1\frac{1}{2}$ x $\frac{7}{8}$; measure and mark with fine pencil point at every inch. Square around the stick through each point, using pencil. Repeat at half inches, using knife, making proper depth of line. Repeat at quarter inches. (See wall-plate for method of holding try square.)

Problem 2. — Repeat, using bevel and square on alternate sides.

Problem 3. — Repeat, using bevel on four sides.

Lesson IV.— Gauging.

Problem 1. — Take a piece 8 x 2 x $\frac{5}{16}$; set gauge $\frac{1}{2}$ in. and make four lines. Continually set gauge $\frac{1}{16}$ in. less, making four lines each time

till $\frac{1}{16}$ in. setting is reached. Then fill the rest of one side of board with lines $\frac{1}{16}$ in. apart, leaving opposite side to write name and number of piece. (See wall-plate for manner of holding gauge.)

Problem 2.—Take a piece $6 \times 1\frac{1}{2} \times \frac{5}{16}$, and fill with lines $\frac{1}{16}$ in. apart, as fine as can be made uniform.

Problem 3.—Take a piece $4 \times 2 \times \frac{7}{8}$; fill edges and ends with lines $\frac{1}{16}$ in apart.

Problem 4.—Take a piece $4 \times 2 \times \frac{5}{16}$; square across on one face $\frac{1}{8}$ in. from each end with knife; gauge $\frac{1}{8}$ in. from each edge between knife lines; square again $\frac{1}{4}$ in. from ends between gauge lines; then gauge $\frac{1}{4}$ in. from each edge between square lines, and so fill the board, leaving $\frac{1}{2}$ in. width in centre for name.

Problem 5.—On reverse side of Problem 4 make diagonals; gauge between them at every $\frac{1}{8}$ in., and square with knife at intersection of diagonals with gauge lines.

Lesson V.—Saw to Line.

Problem 1.—Explain difference between slitting and cutting-off saws.

Problem 2.—Take a piece $4 \times 2 \times \frac{7}{8}$ and teach to start kerf.

Problem 3.—Take a piece $8 \times 2 \times \frac{7}{8}$; gauge at every $\frac{1}{4}$ in. on sides and ends; square at every inch on sides and edges. Slit-saw, taking out one-half of a gauge line, till the first squared line is reached. Rectify all wrong sawing and proceed downward another inch; rectify and proceed a third inch; fill both ends of the stick in this manner.

Problem 4.—Repeat, sawing as far from line as width of kerf.

Problem 5.—Take a piece $8 \times 3\frac{1}{2} \times \frac{7}{8}$; gauge and square at every $\frac{1}{2}$ in., and practise as above, with cutting-off saw.

Lesson VI.—Surface Planing.

First describe minutely each of the three planes on the bench, having every pupil take his plane apart, reassemble it and adjust it. A plane is properly adjusted when the middle of its cutting edge passes below the plane block so as to shave the wood, while the ends of the cutting edge do not reach down far enough to shave. Pupils should do this adjusting, but the edge must be put in order by the teacher or by pupils in advanced classes, as ability to sharpen a tool cannot easily be acquired in advance of the ability to use it.

From $\frac{7}{8}$ in. boards of any width saw pieces $8\frac{1}{2}$ in. long, and supply each member of the class with a piece. From these are to be finished boards 8 in. long by $2\frac{3}{4}$ in. wide, observing the following order of operations: First, rough saw the piece in strips 3 in. wide. Second, rough-plane the edges until all the saw marks are removed. Third, clean off the sides, using the finishing plane, and removing as little wood as possible, thus: Suppose lines to be drawn lengthwise about $\frac{3}{4}$ in. apart. (See Fig. 1.)

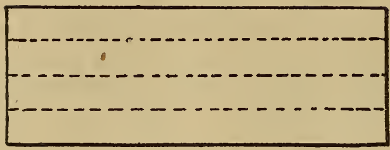


FIG. 1.

Move the plane first so as to have the middle of the shaving which it cuts come from the middle of the first section. (Be sure the plane cuts a shaving along the entire length of the board.) Next, plane in like manner the second section, then the third, and so continue till the whole surface is clean.

Fourth, true the sides thus: Test a side crosswise, in three places, as shown at Fig. 2, viz., near each end, and in the middle, holding the work

FIG. 2.

with the straight edge on it, up between the eye and a light window, then plane where the test has shown the surface to be too high. Next test lengthwise in three places as shown at Fig. 3, viz., near each edge and along the middle, and plane where these tests show the surface to

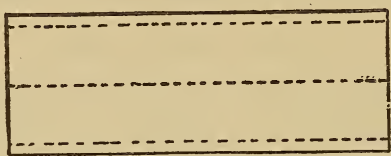


FIG. 3.

be too high, being careful in all these planings not to plane such portions of the surface as the tests show to be already sufficiently low. Next test on both diagonals as shown at Fig. 4, and plane off the high portions. Finally, repeat the above eight tests, and, if the surface

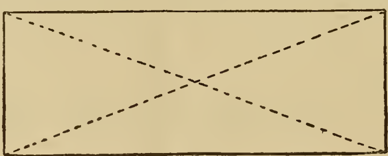


FIG. 4.

proves true, put a pencil mark on the side thus trued. (See Fig. 5.) This pencil mark is known as a tried mark, and indicates that the first

side is tested and proved true. Plane and test the opposite side in the same manner, but do not put a tried mark on it. Mark it with a figure 2, to indicate that it is finished.

Fig. 5.

Fifth, plane the edge next the tried mark, testing it with the straight edge lengthwise, and the try square three times, viz., near each end and near the middle, squaring from the tried side. Pencil a tried mark also on this edge. (See Fig. 6.)

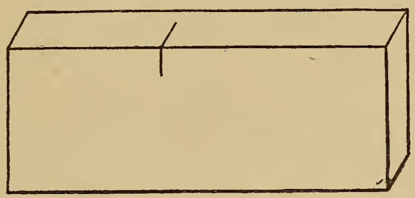


Fig. 6.

Sixth, set the gauge $2\frac{3}{4}$ in. *plus* — this will be practising Rule First, page 191. Plus measurement means setting the gauge to the farther side of the graduation line. Gauge from the tried edge on both sides of the board — this will be practising Rule Second Rough-plane near to the gauge lines — this will be practising Rule Third. Finally, finish plane exactly to the lines — this will be practising Rule Fourth.

Seventh, square around the board about $\frac{1}{4}$ in. from one end, using knife and try square, squaring in all cases from the tried side and tried edge. Saw near to the line, and then, holding the work in the vise, plane to the squared lines, using the block plane.

Eighth, measure from this finished end 8 in. *plus* (Rule 1), square around as before (Rule 2), saw near to the line (Rule 3), and plane to the line (Rule 4).

Lesson VII. — Boring.

Problem 1. — Take one of the boards planed in the previous lesson, gauge from the tried face on both of the adjacent edges $\frac{7}{16}$ in.; square around at every $\frac{3}{4}$ in., squaring from the tried edge; bore with $\frac{1}{4}$ in. auger bit from intersection of lines on one edge till point of bit meets intersection on opposite edge.

Problem 2. — Saw off one of the boards made in previous lesson 5 in. long; lay out three intersections on each end, and bore lengthwise in a similar manner.

Problem 3. — Repeat with board 8 in. long, boring from each end.

Lesson VIII.— Brad-awl.

Take a board planed in previous lesson, to $\frac{5}{8}$ in. thickness, gauge and square lines $\frac{1}{2}$ in. apart on both sides. Awl from intersections on one side to intersections on the other side.

Lesson IX.— Shove Planing.— Cut to Width.

Problem 1.— Take a soft, straight-grained pine board, $\frac{1}{4}$ in. thick, about 4 ft. long by 6 in. wide. If end of board be not clean wood, first saw off $\frac{1}{2}$ in. or more, to waste. Next saw off a piece $4\frac{1}{2}$ in. long; hold this piece in vise and plane the edge with wooden plane till roughness is off, then plane edge square and true by means of shove-plane block, using 8 in. Bailey iron plane. Use standard rule to set gauge $\frac{3}{4}$ in. *plus* (Rule 1). Gauge from the finished edge on both sides of the board (Rule 2). Saw near to the line (Rule 3), plane to middle of line, leaving one side of line visible (Rule 4). Carefully plane out gauge lines by the least possible number of full-length shavings. (Never move a plane across a board without perceiving that it cuts.) Make twelve pieces. Six of these pieces placed side by side should measure $4\frac{1}{2}$ in.

Lesson X.— Cut to Length.

Problem 1.— Take three pieces made in Lesson IX.; plane each end on shove-plane block, using 6 in. Bailey iron block plane. Measure from each end 2 in. (Rule 1); square across face with knife (Rule 2); saw near line (Rule 3), and plane to line, leaving half of line visible; then carefully plane out the line (Rule 4). Make six pieces.

Problem 2.— Trim to an exact common length, observing that said common length is just 2 in. In making the above 2 in. measurement, mark it *plus*; that is, put the knife point not against the centre of graduation line, but against the farther side. Then, when lines are planed out, the pieces will be just 2 in. long, and when placed end to end will measure exactly 12 inches.

Problem 3.—Make, as above, two pieces, $4\frac{1}{4}$ in. long.

Problem 4.— Take two pieces of Problem 3, and five pieces of Problem 2, and nail up a case of shelves, using $\frac{5}{8}$ No. 20 wire brads. Make similar problems of other dimensions.

Lesson XI.— Examples Involving Practice in All of the Foregoing Lessons.

Problem 1.— Take $\frac{1}{4}$ in. board $4\frac{1}{2}$ in. long, as in Lesson IX., and make two pieces 2 in. wide.

According to Lesson X., make them 4 in. long.

Also, make four pieces $\frac{3}{4}$ in. wide x 4 in. long and four pieces $\frac{3}{4}$ in. wide x $1\frac{1}{2}$ in. long. Use $\frac{5}{8}$ in. No. 20 wire brads, and nail as in Lesson I., making two boxes, each 4 in. long x 2 in. wide x 1 in. high, outside measure.

Problem 2.— As above, make a box $5 \times 2\frac{1}{2} \times 1\frac{1}{4}$.

Problem 3.— Make a box $4\frac{1}{2} \times 2\frac{1}{4} \times 1\frac{1}{8}$.

Problem 4.— Make a box $4\frac{3}{4} \times 2\frac{3}{8} \times 1\frac{3}{16}$.

Problem 5. — Make a box $4\frac{1}{4}$ x $2\frac{1}{8}$ x $1\frac{1}{16}$.

Ready workmen will finish Problem 5 as soon as backward ones finish Problem 2. Let each pupil study out for himself the dimensions of parts to each box.

Lesson XII. — Hand Screw.

Problem 1. — Exercise in opening and shutting. Set clamp to different widths, as 2 in., 3 in., 4 in., $2\frac{1}{2}$ in., etc. Also set it to hold two, three, or four pieces of $\frac{7}{8}$ boards.

Problem 2. — Make a foot rule. Take $\frac{1}{4}$ in. stock; finish a piece $\frac{7}{8}$ in. wide x 12 in. long; gauge on one face from one edge, $\frac{1}{8}$ in., $\frac{1}{4}$ in., $\frac{3}{8}$ in., $\frac{1}{2}$ in. Lay a standard rule behind it, clamping blocks to bench top at each end; then with knife and try square, make squared lines at every inch, back to $\frac{1}{2}$ in. gauge line; at every $\frac{1}{2}$ in., back to $\frac{3}{8}$ gauge line; at every $\frac{1}{4}$ in., back to $\frac{1}{4}$ gauge line, and at every $\frac{1}{8}$ in., back to $\frac{1}{8}$ in. gauge line. Sharpen hard lead pencil to a goose-bill edge, and blacken all of these lines.

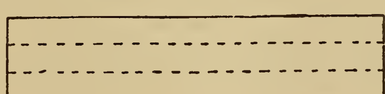
Lesson XIII. — Dividers.

Problem 1. — Take a board 8 x $3\frac{1}{2}$ x $\frac{1}{4}$; gauge $\frac{1}{4}$ in. from one edge on each side; square around near the middle. From intersection of lines on one side measure 2 in. each way on the gauge line, and make an accurate point with hard pencil. Also measure 3 in. each way and every $\frac{1}{8}$ in. between 2 in. and 3 in. From intersection of lines as a centre, describe 9 semicircles passing through points and continuing to edge of board.

Problem 2. — On opposite side of board describe a 3 in. semicircle, and on the right side of the squared line lay off angles 30°, 60°. On the left side lay off 45°, $22\frac{1}{2}$°.

Lesson XIV. — Square Prism. — Forms Developed From It.

Problem 1. — From 2 in. plank 17 in. long saw off strips 2 in. wide; cut in two lengths of $8\frac{1}{2}$ in. each. Plane the sawed edges of each with the wooden plane. Plane one side of each to a *geometrical* surface with the 8 in. iron plane, observing the directions given in Lesson VI. In planing any one surface with either the wooden or iron plane, suppose the surface to be divided into three equal parts or sections by lines running lengthwise, thus: —



Move the plane first so as to have the middle of the shaving which it cuts come from the middle of the front section; move the plane second time so as to have the middle of the shaving come from the middle of the rear section; move it the third time along the middle of the middle section. (Be sure that the plane cuts during the entire stroke.) Test the planed surface with straight edge to see if the middle section is down even with the side sections. If not, take middle sectional shavings till

it is. A side is planed to a geometrical surface when it will pass eight tests with a straight edge, as mentioned in Lesson VI. A block similar to the above needs to hang on a leg of the bench, and be kept as a part of its equipment, to test the adjustment of plane when required. Write name on this first side when completed. Next plane an adjacent side to a geometrical surface in a similar manner, making it square with first side by using try square instead of straight edge in making the three width tests. The third side is finished by gauging $1\frac{3}{4}$ in. *plus* from first or name side, planing to middle of gauge line, then carefully planing gauge line out to leave clear corners, observing all the above directions concerning sectional shavings and straight-edge tests. Supply ready pupils with work while the entire class are making these two blocks, by allowing each one to make as many as he can do well. Great care must be used in planing first and second sides, not to remove much stock, if the pupil would accomplish the desired object of finishing the blocks $1\frac{3}{4}$ in. square. In case of too much removal, make the blocks $\frac{1}{16}$ in. smaller.

Problem 2.—Block plane ends of above, making them 8 in. long. Use for this the 6 in. Bailey iron block plane. First, square around about $\frac{1}{4}$ in. from one end with knife and try square; next, saw very near this line nearly half way through; turn the block one-quarter of a revolution away from you and saw as before; repeat with third side, then with fourth side, finishing the cut. If skill has been exercised, very little is left to plane. If the sawing has been done far from the line, a chisel had better be used before planing. Hold block in vise vertically, and plane from every side towards the middle. The corners will be split off if the plane be driven entirely across the end. Measure 8 in. *plus* from this finished end, square, saw and plane as before. In doing the above recall the four fundamental rules.

Problem 3.—Take one of the above pieces and lay out an octagon on each end. The distance from a corner of the square to a corner of the octagon is the semi-diagonal of the square. Plane to these lines, making an octagonal prism.

Problem 4.—Make an octagonal pyramid 3 in. long on one end of octagonal prism, using chisel and plane; and an octagonal head on the opposite end, using chisel.

Problem 5.—Take another square block from Problem 1; make first an octagonal prism; then, by planing its corners, a sixteen-sided prism, then a thirty-two-sided prism, and finally a cylinder.

Problem 6.—Make a cone on one end of the cylinder of Problem 5, and a sphere on the other, operating as in Problems 4 and 5.

Lesson XV.—Bread Board.

Supply each pupil with a piece of $\frac{7}{8}$ in. white-wood, and have him make a bread board 9 in. x 12 in., observing carefully all directions given in Lesson VI. Cut off the corners 2 in. on the ends and 3 in. on the edges, making the surface eight-sided. Chamfer all corners $\frac{1}{8}$ in. Sand-paper the finished work. Let such pupils as wish to pay the cost of the lumber have this board to carry home.

Lesson XVI. — Bevelled Joints.

Have each pupil draw a bevelled joint of $\frac{7}{8}$ in. thickness, 3 in. high, 5 in. long on the upper side, and 4 in. long on the lower, that is, the amount of bevel being 1 in. in the height of joint. Explain thoroughly the details of laying out and making the joint, after which each pupil should follow them, observing all previous instructions which apply.

Lesson XVII. — Knife Box.

As each pupil completes his bevelled joint have him draw and make a knife box of $\frac{3}{8}$ in. white-wood, 2 in. high, 12 in. x 8 in. on the top and 10 in. x 6 in. on the bottom, with a partition through the middle lengthwise $3\frac{3}{4}$ in. high, having a hole for a handle. This box may be stained black walnut or cherry and shellacked, or it may be varnished in native color. Allow each pupil to have his own work by paying for the lumber.

Lesson XVIII. — Chisel.

Problem 1. — Make, as in Lesson VI., two boards $8\frac{1}{4}$ in. x 2 in. x $\frac{7}{8}$ in., gauge from one edge of each board $\frac{3}{4}$ in. on the adjacent side; measure on this edge and place points at every $\frac{3}{4}$ in.; square with the knife through each of these points across the edge and on both the adjacent sides as far as the gauge lines. Cut out each alternate $\frac{3}{4}$ in. section so laid out by sawing near to the lines and then chiselling exactly to the lines.

Problem 2. — Make a board 8 in. x $3\frac{1}{16}$ in. x $\frac{7}{8}$ in. Gauge $\frac{1}{2}$ in. from one side on both edges and ends. On this side, and on edges and ends down as far as to gauge line, lay out the board in $\frac{1}{2}$ in. squares. Chisel to these lines in such a manner as to form on the side of the board a group of square pyramids whose apices shall be 1 in. apart and whose altitudes shall be $\frac{1}{2}$ in.

Lesson XIX. — Gouge.

Problem 1. — Make a board 8 in. x $3\frac{1}{16}$ in. x $\frac{7}{8}$ in. On one side of it gauge lines lengthwise at every $\frac{7}{16}$ in. With the gouge cut semicircular grooves in alternate spaces, using corner of try square to test accuracy of semicircle.

Problem 2. — Repeat Problem 1, squaring lines crosswise at every $\frac{7}{16}$ in.

Lesson XX. — Screw Driver.

Problem 1. — Make two soft-wood boards 8 in. x 2 in. x $\frac{7}{8}$ in. On one side of one of them square lines one inch from each end; square three more lines $1\frac{1}{2}$ in. apart between these, and gauge a line $\frac{1}{2}$ in. from each edge.

With the $\frac{7}{32}$ in. drill bit, bore holes through the board at five of the intersections, the location of the holes forming a zigzag line. Place the second board underneath the first, insert five $1\frac{1}{2}$ in No. 11 screws in the bored holes, and turn them down with the screw driver till the heads come flush with the surface of the upper board.

Problem 2. — Repeat Problem 1, using maple or some hard wood. Through the upper board bore $\frac{7}{32}$ in. holes and countersink them. Bore $\frac{5}{32}$ in. holes half way through the lower board, and dip the end of each screw in tallow before using it.

The above elementary course gives practice with each class of tools

mentioned in the list on page 188, and occupies pupils of the senior grammar grade during one year of forty weeks, one lesson of one and one-half hours' duration being taken each week.

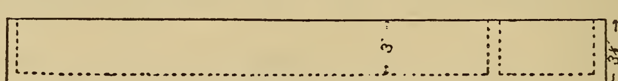
High-school Work.

The class of freshmen organized last September numbers thirteen, six of whom are from the scientific and manual course, and seven from the Latin course. Problems in joinery made by this class are shown on page 201, where they are one-tenth size, except the frames, Nos. 7 and 8, and the drawing board, T square and triangles, No. 15. The joints of these triangles are secured by means of glue and dowels made from ½ in. No. 21 wire brads. The drawings from which this plate was photographed were made by pupils of the school.

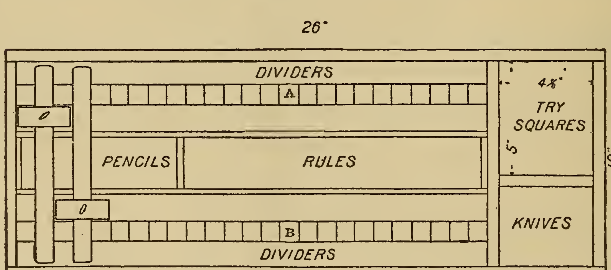
The problems are all of pine except the triangles, which are of cherry. They are numbered and named as follows: No. 1, halved corner joint; No. 2, halved with relish joint; No. 3, bevelled halved joint; No. 4, dovetailed halved joint; No. 5, flat mitre joint; No. 6, mortise and tenon joint; No 7, mitred frame, 8 x 10; No. 8, mortised frame, 8 x 10; No. 9, dowelled joint; No. 10, dado joint; No. 11, drawer front joint; No. 12, erect mitre joint; No. 13, mitre and halved joint; No. 14, mitre and mortised joint; No. 15, drawing board, 21 x 28; No. 16, 45° triangle, 6 in. base; No. 17, 30° and 60° triangle, 5 in. base; No. 18, T square, 2¼ in. width of blade and head; No. 19, straight splice; No. 20, bevelled splice.

In addition to these joints many of the pupils made each a foundry flask, having dovetailed corners, for his own use next year, and a box for holding the tools used in knife work in lower grammar grades. (See cut below.)

Turning problems will be found on pages 202–205, inclusive; carving problems on pages 206–210, inclusive; pattern-making problems on pages 213, 214.



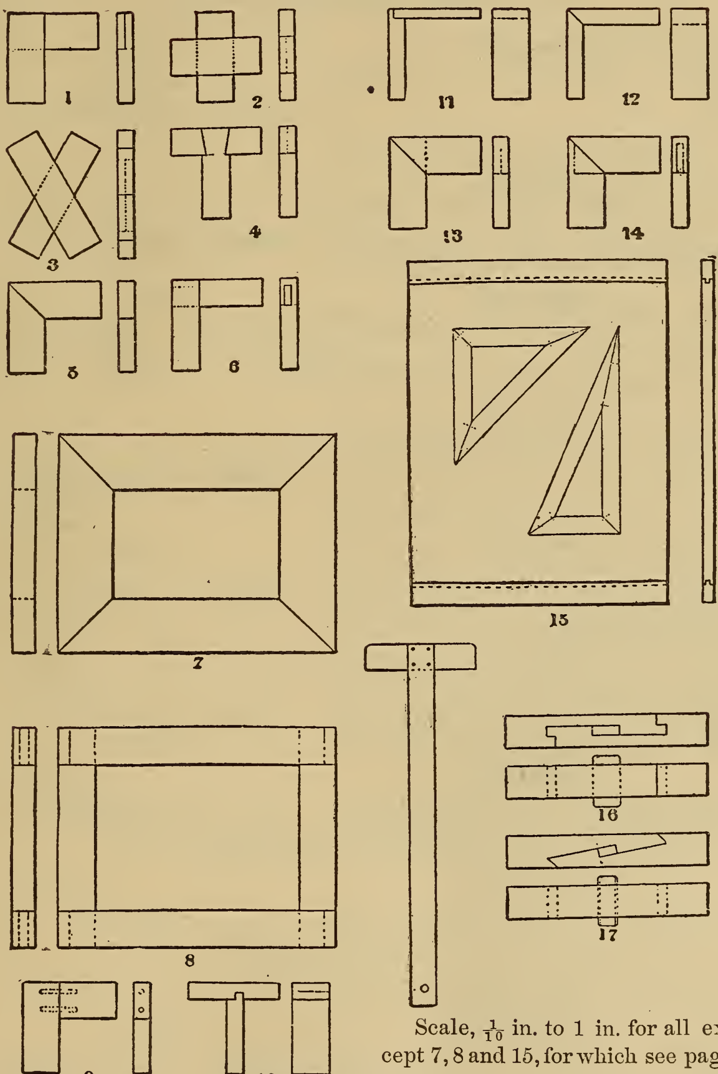
ELEVATION.



PLAN.

ELEVATION OF THE STRIPS A AND B.

JOINERY PROBLEMS.

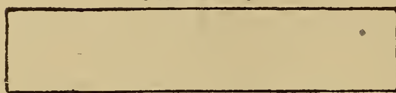


Scale, $\frac{1}{10}$ in. to 1 in. for all except 7, 8 and 15, for which see page 200.

Turning Problems.

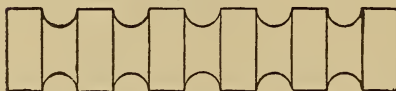
Series First.—Elementary Centre Work.

Problem 1.



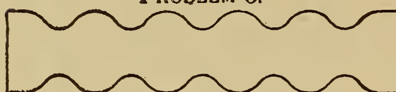
Problem 1. Cylinder.

Problem 2.



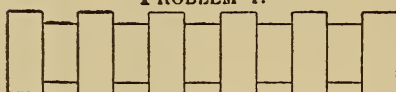
Problem 2. Hollows.

Problem 3.



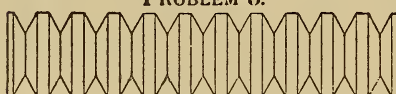
Problem 3. Rounded hollows.

Problem 4.



Problem 4. Square grooves.

Problem 5.



Problem 5. V grooves.

Problem 6.

Problem 6. Beads.

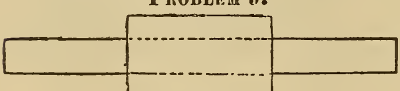
Problem 7.

Problem 7. Beads, fillets and hollows.

Problem 8.

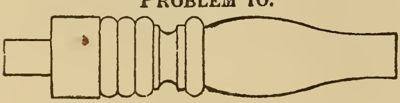
Problem 8. Ovolos and cavettos.

Problem 9.



Problem 9. Hollow cylinder on arbor.

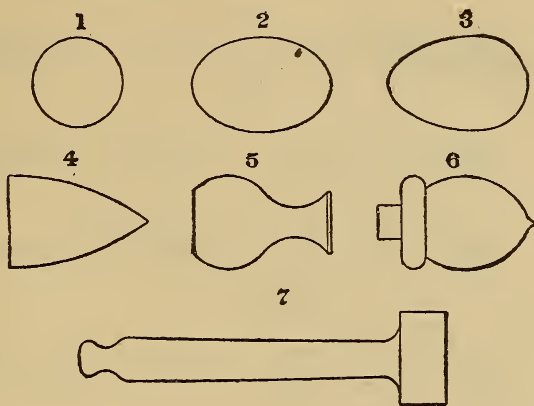
Problem 10.



Problem 10. Stool leg, with tenon on one end to fit bored hole.

Series Second. — *Templet Forms.*

Problem 1.
Sphere.
Problem 2.
Ellipsoid.
Problem 3.
Ovoid.
Problem 4.
Conoid.
Problem 5.
Vase.
Problem 6.
Acorn.
Problem 7.
Masher.



Series Third. — *Polished Forms.*

Problem 1.
Ball bat.

Problem 2.
Billy.

Problem 3.
Shank chisel handle.

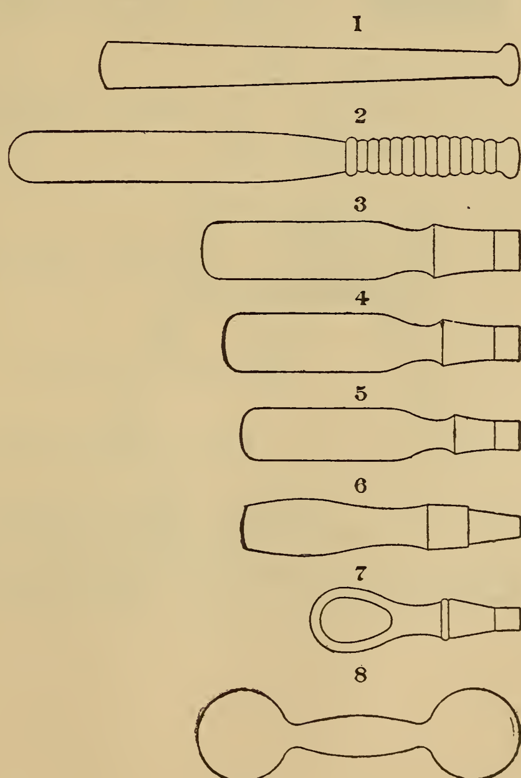
Problem 4.
Shank chisel handle.

Problem 5.
Shank chisel handle.

Problem 6.
Socket chisel handle.

Problem 7.
Screw-driver handle.

Problem 8.
Dumb bell.

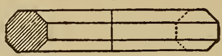


Series Fourth.—Face Plate Work.

1

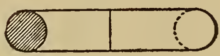
Problem 1. Moulding.

2



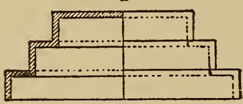
Problem 2. Octagonal ring.

3



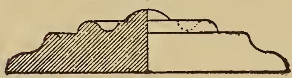
Problem 3. Round ring.

4



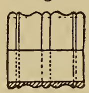
Problem 4. Cone pulley.

5



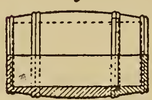
Problem 5. Polished hard-wood rosette.

6



Problem 6. Napkin ring.

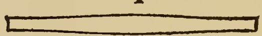
7



Problem 7. Match barrel.

Series Fifth.—Long Work.

1

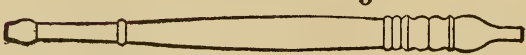


Problem 1. Plain chair round.

2

Problem 2. Ornamental chair round.

3



Problem 3. Chair leg.

Series Sixth.—Assembled Work.

Problem 1.

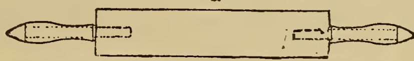
Mallet.

1

Problem 2.

Rolling pin.

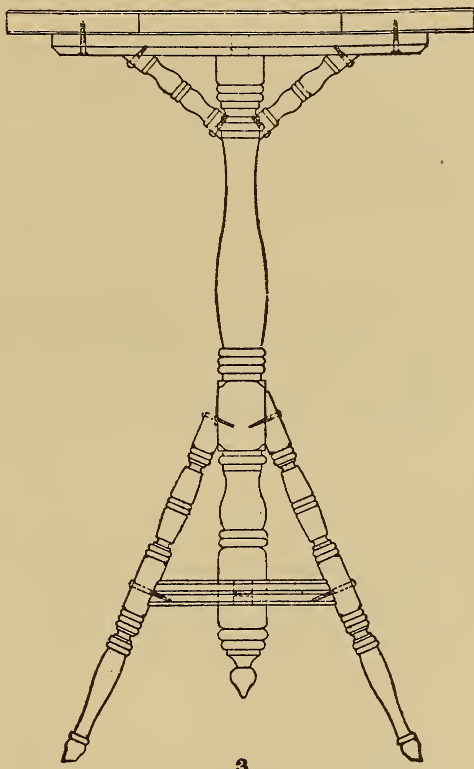
2



Problem 3.

Light stand.

The top of this stand is octagonal in form. There are four legs and four braces, but only two of each are shown, for clearness. They are secured in place by means of screws.



3

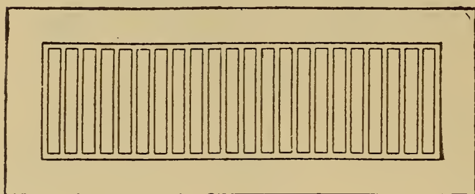
The above prints of turning problems are all one-quarter size, except series fifth and sixth, which are one-eighth size.

Carving Problems.

Incised Work.

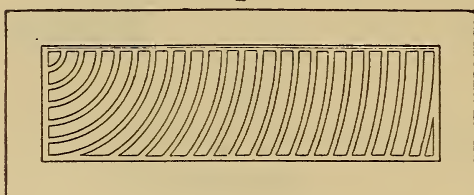
Against each problem is a list of the tools used in carving it. The size and number correspond with J. B. Addis' catalogue. The boards are prepared by machinery, and are of $\frac{1}{2}$ in. pine, except Problem 11, which is $\frac{7}{8}$ in., and which is prepared by pupils. The prints are from drawings made by pupils, and are one-quarter size.

1



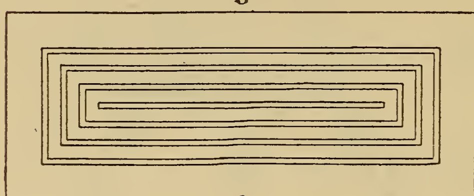
Problem 1.
Veiner, $\frac{1}{8}$ in., No. 11.

2



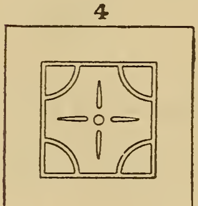
Problem 2.
Veiner, $\frac{1}{8}$ in., No. 11.

3

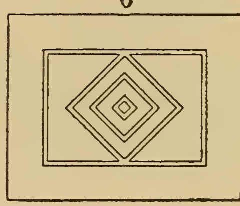


Problem 3.
Veiner, $\frac{1}{8}$ in., No. 11.

4



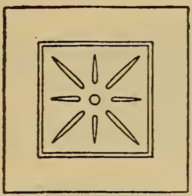
6



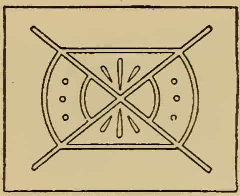
Problems 4 *and* 6.
Veiner, $\frac{3}{32}$ in., No. 11.
Gouge, $\frac{3}{16}$ in., No. 9.

Problems 5 *and* 7.
Veiner, $\frac{3}{32}$ in., No. 11.
Gouge, $\frac{3}{16}$ in., No. 9.

5

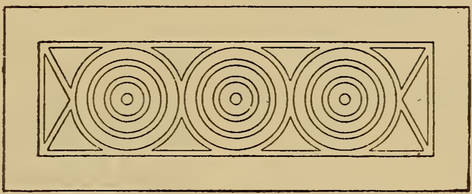


7



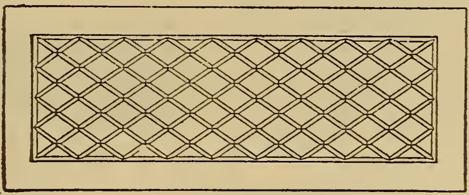
Problem 8.
Veiner, $\frac{1}{8}$ in., No. 11.
Gouge, $\frac{3}{16}$ in., No. 9.

8



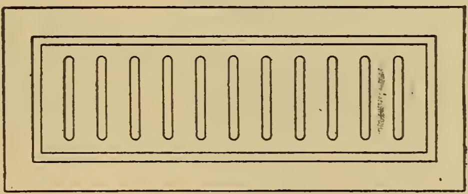
Problem 9.
Veiner, $\frac{3}{32}$ in., No. 11.

9



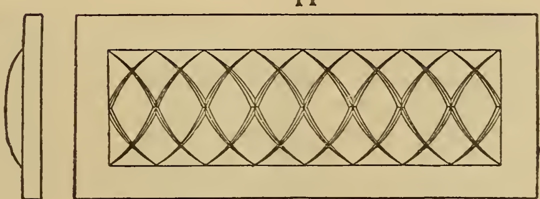
Problem 10.
Veiner, $\frac{1}{4}$ in., No. 11.

10

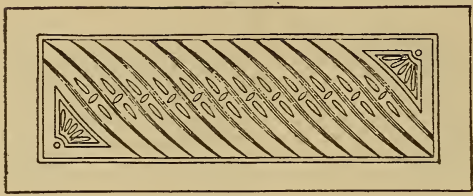


Problem 11.
Parting tool,
$\frac{1}{8}$ in., No. 39.

11

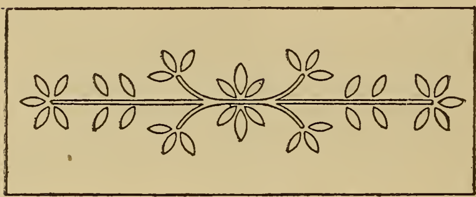


12



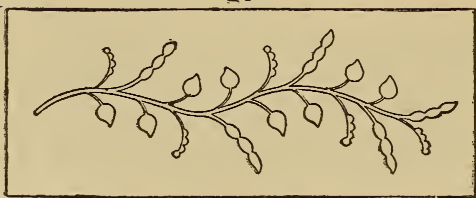
Problem 12.
Veiner, $\frac{3}{32}$ in., No. 11.
Parting tool, $\frac{1}{8}$ in., No. 39.

13



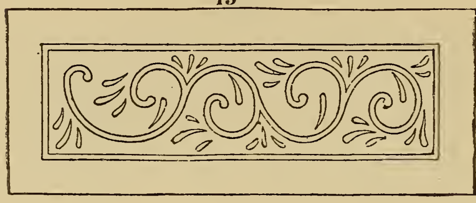
Problem 13.
Veiner, $\frac{3}{32}$ in., No. 11.
Flat gouge, $\frac{1}{2}$ in., No. 7.

14



Problem 14.
Veiner, $\frac{3}{32}$ in., No. 11.
Gouge, $\frac{3}{16}$ in., No. 9.
Gouge, $\frac{3}{8}$ in., No. 9.
Flat gouge, $\frac{3}{4}$ in., No. 4.
Flat gouge, $\frac{5}{8}$ in., No. 5.
Flat gouge, $\frac{1}{2}$ in., No. 7.

15



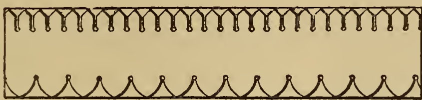
Problem 15.
Veiner, $\frac{3}{32}$ in., No. 11.
Gouge, $\frac{3}{16}$ in., No. 9.

Problems 1 to 4, on the following page, are executed on the four sides of a hard-wood block $2\frac{1}{4}$ in. square, and require the following tools: $\frac{1}{4}$ in. No. 1, $\frac{1}{2}$ in. No. 1, $\frac{3}{8}$ in. No. 2, $\frac{5}{8}$ in. No. 5, $\frac{1}{8}$ in. No. 7, $\frac{1}{4}$ in. stamp.

Problems 5 to 8 are executed on $\frac{1}{2}$ in. pine. Problems 9, 10 and 11 constitute one exercise, portions of the class working on each. They are on $\frac{7}{8}$ in. cherry. Problem 12 is on $\frac{1}{2}$ in. baywood.

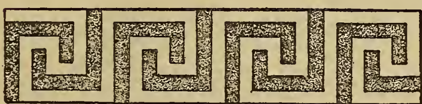
To execute each of these requires from one-half to all of the tools.

Relief Work.

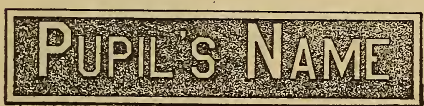


1

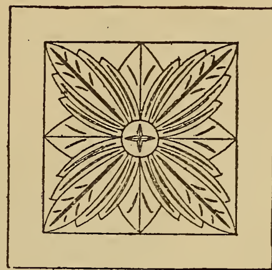
2



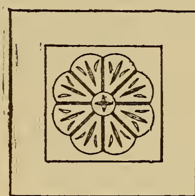
3



4



5



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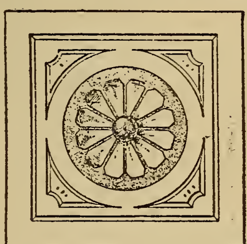

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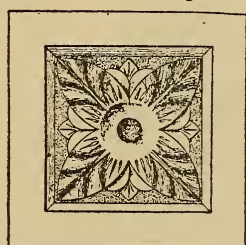

8

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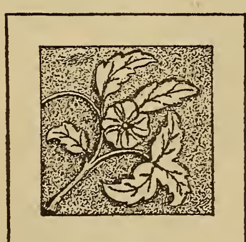
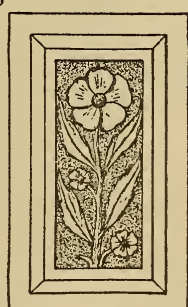


10



11

Scale for this page, $\frac{1}{4}$ in. to 1 in.

12

One-half size.

Pattern-Making.

Solid Blocks.

Problem 1.—The cuts on page 213 give three views of a planed iron block 4 in. x 3 in. x $\frac{5}{8}$ in., for which block three patterns are made; the first is to be moulded with a side uppermost, the second with an edge uppermost and the third with an end uppermost, shrinkage, draft and finish being allowed for in each case. *Problem 2* is two views of a block 3 in. long x $1\frac{1}{2}$ in. square, of which three patterns are made, to be moulded first with a side uppermost, second with a corner uppermost, third with an end uppermost, shrinkage, draft and finish being allowed for, as in Problem 1. *Problem 3* is two views of a cylinder, for which two patterns are made (by planing, not by turning), one being moulded sidewise and one endwise. *Problem 4* is three views of a box 8 in. x 4 in. x $2\frac{1}{2}$ in., having $\frac{5}{8}$ in. thickness of stock. An important item of instruction which it furnishes is the shaping of its end pieces. Leather corners are also introduced with this problem.

Green Sand Cores.

Problem 5 is two views of a flat pattern 10 in. x 3 in. x $\frac{7}{8}$ in., through which three holes are cut, square, round and hexagonal, respectively.

Dried Sand Cores.

Problem 7 is two views of a flat casting 5 in. x 3 in. x $\frac{7}{8}$ in., cored so as to leave $\frac{3}{16}$ in. thickness of stock.

Problem 8 is two views of a hollow square prism, of which two patterns are made, drawing cornerwise and endwise, respectively. *Problem 9* is two views of a hollow cylinder 3 in. by $1\frac{1}{2}$ in., of which two turned patterns are made, drawing sidewise and endwise, respectively.

Problem 10 is three views, A, B, C, of a pattern having depressed core prints. It is required to mould a block 4 in. x 3 in. x $1\frac{3}{4}$ in., with an edge uppermost, and a core passing horizontally through the centre of the block. The dotted lines show where the cored hole will be.

Problem 11 is three views, D, E, F, of a pattern having a depressed core passing at an angle through the middle of a block 4 in. x 3 in. x $1\frac{3}{4}$ in. The dotted lines show where the cored hole will be. The invisible corners of the core prints are not represented on D.

Bosses.

Problem 6 is a pattern similar to Problem 5, but having bosses instead of holes.

Problem 12 is three views of a block, 4 in. x 3 in. x $1\frac{3}{4}$ in., having a depressed boss on each side. Each boss is connected to the main pattern by a dovetail, and is to be drawn from the mould after the main pattern is drawn.

Divided and Dowelled Patterns.

Problem 13 is a pattern of a flat block, 4 in. x 3 in. x $1\frac{3}{4}$ in., divided in the middle and dowelled.

Problem 14 is a turned pattern of a hollow cylinder, 3 in. x $1\frac{1}{2}$ in., divided and dowelled.

Construction Patterns.

Problem 15 is three views of a pipe, T pattern, one-fifth size.

Problem 16 is one view of a pipe, elbow pattern, one-fifth size, showing the extra length of core prints necessary to balance.

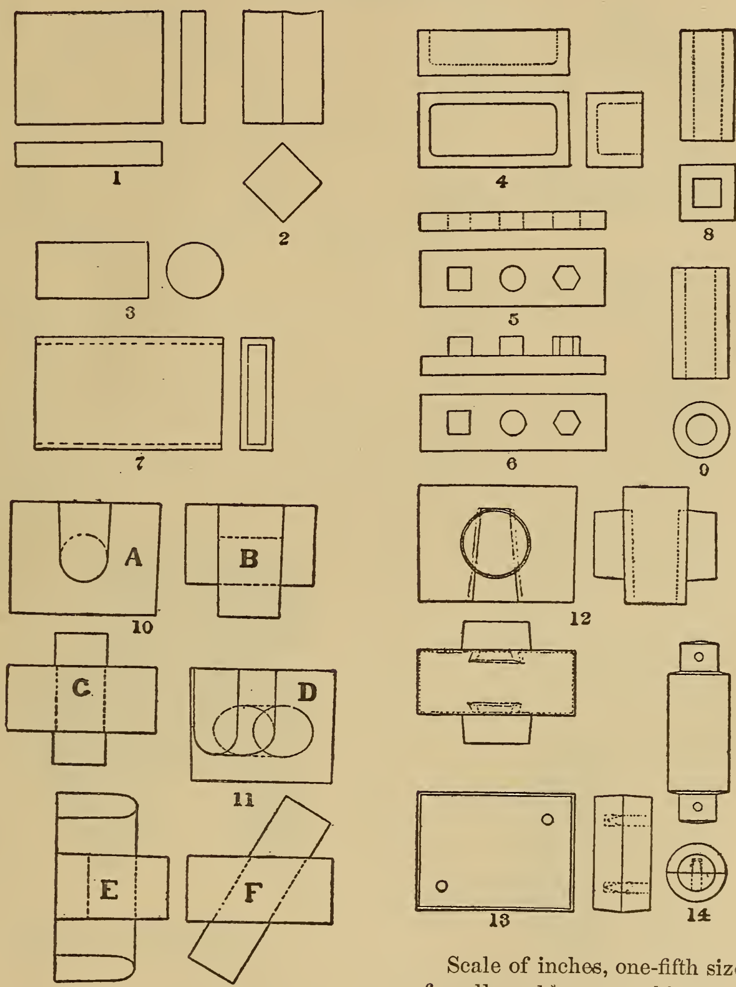
Problem 17 is a hitching-post head pattern, one-tenth size, showing extra length of core prints necessary to balance.

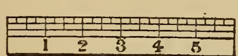
Problem 18 is a solid pulley pattern, one-fifth size, the spokes being whittled with a knife after turning.

Problem 19 is two orthographic views and one isometric view of a steam cylinder, one-fifth size, a project requiring much time and patience to execute.

A core box was made as needed with each of the above pattern problems, and at the close of the series each member of the class moulded his own pattern and obtained a plaster of Paris casting from it.

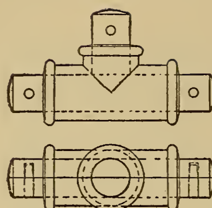
Elementary Patterns.





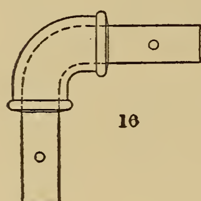
Scale of inches, one-fifth size for all problems on this page except 5 and 6, which are one-tenth size. (See page 211.)

Construction Patterns.

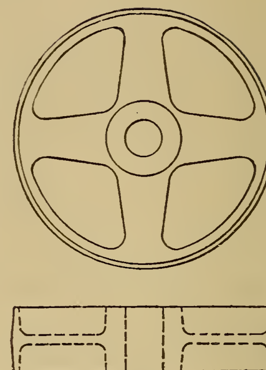


15

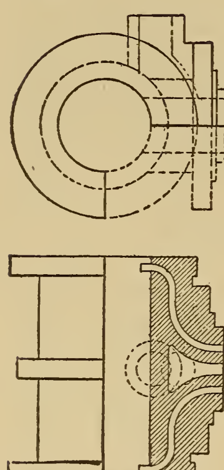
17

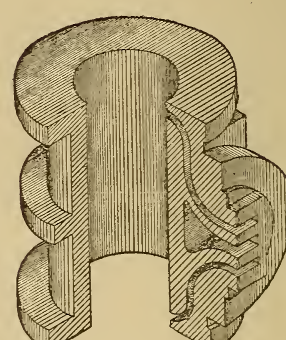


16

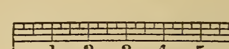


18





19



Scale of inches, one-fifth size for all of the problems on this page except 17, which is one-tenth size. (See page 212.)

Appendix J.

INDUSTRIAL EDUCATION AND MANUAL TRAINING IN NEW JERSEY.*

By Mr. C. E. MELENEY, Superintendent of Public Schools, Somerville.

In 1881 the Legislature of New Jersey passed a bill guaranteeing that the State would duplicate, out of the funds in the State treasury, any amount of money, between $3,000 and $5,000, that might be raised in any locality in the State, either by subscription or by appropriation, for the purpose of establishing a school or schools for industrial education; and, after such school or schools have been established, that there should be appropriated annually a sum equal to that raised each year by the locality.

The first city to profit by this legislation was Newark, the metropolis of the State, one of the great manufacturing cities of the country. A fund of $5,000 was raised by the citizens, who guaranteed to duplicate their subscription for five years. The board of trustees provided for in the law was organized as follows: the governor, who is ex officio the president of the board, two members appointed by the subscribers, two appointed by the city board of education and two by the city council. These trustees receive no compensation for their services, but any expenses incurred by them in the discharge of their duties is paid upon the approval of the governor.

In 1890 an act making the trustees a corporate body was passed by the Legislature. The act of 1881 read as follows: —

Be it enacted by the Senate and General Assembly of the State of New Jersey, that whenever any board of education, school committee or other like body, of any city, town or township in this State, shall certify to the governor that a sum of money, not less than $3,000, has been contributed by voluntary subscriptions of citizens or otherwise, as hereinafter authorized, for the establishment in any such city, town or township, of any school or schools for industrial education, it shall be the duty of said

* Report of testimony given before the Commission.

governor to cause to be drawn, by warrant of the comptroller, approved by himself, out of any moneys in the State treasury not otherwise appropriated, an amount equal to that contributed by the particular locality as aforesaid for the said object; and when any such school or schools shall have been established in any locality as aforesaid, there shall be annually contributed by the State in manner aforesaid, for the maintenance and support thereof, a sum of money equal to that contributed each year, in said locality, for such purpose: *provided, however*, that the moneys contributed by the State as aforesaid to any locality shall not exceed in any one year the sum of $5,000.

With a fund of $10,000 the Newark Technical School was opened in 1885, as an evening school, the persons whom it was intended to benefit being of the working classes, engaged during the day in the various manufacturing industries of the city.

As stated in the catalogue, "The object of the Newark Technical School is the advancement of the manufacturing interests of the city, and its course is arranged with special reference to the intellectual wants and improvements of the working classes;" and, in order that as many pupils as possible from the working classes could attend the school, it was instituted in the evening.

As this school is pre-eminently an industrial school, the course of study is arranged accordingly. The preparatory class includes arithmetic, writing and composition. First year, algebra, physics, descriptive chemistry, free-hand drawing. Second year, geometry, free-hand drawing, descriptive chemistry finished, lectures on agriculture and technical chemistry, the latter referring to the application of chemistry in manufacturing industries, and including among others the following subjects: soap, illuminating gas, coal tar and its derivatives, sugars, photography, bleaching, dyes, dyeing and tissue printing. Third year, algebra completed, geometry completed, theory of cutting tools, mechanical or architectural drawing, physics and its divisions. Fourth year, trigonometry, mechanics, technical chemistry, descriptive geometry, mechanical or architectural drawing, steam engineering, a course of ten lectures on the physical properties of steam, steam generators, steam motors and the indicator.

Owing to the limited resources, they have no shop work, but the students are usually employed in shops during the daytime, and the director of the school frequently visits the shops where the students are employed.

The institution is very well supplied with models and patterns for drawing, etc., and it is intended that the various stages of manufacture shall be illustrated, as far as possible, from the raw material to the finished article, specimens of which are supplied

for the school cabinets. The work in chemistry consists of lectures and experiments, but without the laboratory work by the pupils.

Sessions are held from 7 to 9.30, three evenings each week.

For five years the subscribers contributed according to their agreement, thus securing in all $50,000 for the school. It is now supported by an annual appropriation by the city of $5,000, to which is added each year an equivalent sum from the State. Each year a portion of this amount is set aside as a permanent building fund, the intention being to raise a sufficient sum to erect a building, to be located upon a lot already purchased.

"As soon as the new building is ready the trustees expect to announce the opening of a day school with particular reference to the artistic side of manufacturing. Instruction at first will be given in drawing, modelling in clay, designing, engraving and chasing on metals, and repoussé work. The course of study will probably extend over two years, and applicants who are fourteen years of age or older will be received without reference to place of residence."

The Newark Technical School is the only institution operating under the law of 1881. Nevertheless, a great interest was manifested in the subject of manual training by the leading educators of the State, and some cities began to consider the adoption of some of its features in the public schools. The most notable work of this kind was inaugurated in Montclair under the direction of Randall Spaulding, superintendent of schools, who says, in a letter of recent date: —

In 1881 the town of Montclair started a manual training movement, on quite a definite basis and without any aid from the State. A special committee was appointed, which looked up the subject of manual training; an instructor was appointed to teach pupils from the grammar schools, from twelve to fourteen years of age. A course of manual training was laid out, work was begun on Oct. 1, 1882, and the seventh and eighth grade grammar scholars, averaging twelve and one-half years, were selected. As now arranged, instruction is given to both boys and girls of the first-year grammar school in drawing and construction of geometric forms and in clay modelling, to the second-year boys in carpentry, and to the third-year boys in wood carving. While the boys are in the workshop the girls receive from their regular teachers instruction in needle-work, embroidery and plain sewing. They design and draw patterns and then transfer them to the goods, then they work out the patterns with colored wools and silk. The course of sewing occupies three years, including all the stitches in the making and repairing of garments. In the higher grade more advanced lessons and more difficult work in garment making are given. After plain sew-

ing comes ornamental work to some extent, the Kensington stitch being chiefly used. The pupils invent designs sometimes, and select patterns which are executed in scarfs for tables, splashers, bureau covers, etc. The time devoted to the work has been one hour twice a week for three years.

The aim of the industrial work is to discipline the mind through the hand and the eye. The shop work is but one part of the manual training begun in the lowest grade and continued in the high; there the pupils are given laboratory work in physics and chemistry, and encouraged to make their own apparatus. The time devoted to the work has been one hour twice a week in school hours.

This school accommodates all the grammar and high school pupils in the town, and is located in two buildings, which are about to give way for a new, fine building now being erected upon the plans of the well-known Boston architects, Loring & Phipps.

During my residence in New Jersey it was my privilege to be quite intimate with Mr. Spaulding and to frequently visit his school, so that I know the history and progress of the work from the outset; but since my return to Massachusetts I have not kept myself informed of the advancement made in that State, and have been obliged to correspond with my friends there to enable me to prepare for this interview. I shall have occasion to submit to you statements from superintendents of cities and from the State Board of Education. Upon the subject of equipment, Mr. Spaulding says: —

1. Amount raised annually by taxation for manual training is $1,000.

2. Amount received annually from the State for manual training is $1,000.

3. Amount spent in year ending June 1, 1890, $1,607; in year ending June 1, 1891, $1,550.

4. Nothing sold, and no receipts.

5. Present equipment as follows: Twenty-five sets of carpenters' tools, at $25 a set, $250; thirty-five sets of wood-carving tools, at $3.50 a set, $122.50; twelve benches, at $19.25 each, $231; machinery, engine, lattres, vises, etc., $2,000; plumbing for engine, $40; building, $1,000; total, $3,643.50.

The ninth-grade boys have cabinet work, eighth-grade boys have wood carving, ninth-grade boys have machine and vise work; ninth-grade girls have wood carving. All pupils spend two hours per week in manual training, — that is, in the above-mentioned grades.

The above estimate does not include the cooking department, nor the advanced clay modelling.

I have given you an account of all that was done in the State under the act of 1881, viz., the Newark Technical School. I

have also given a brief account of the work in Montclair, which was begun without State aid, but which has continued and developed under the second act of legislation, which I shall now describe.

The first law was enacted to stimulate *industrial* education, before educators and legislators comprehended the educational value of manual occupation as a feature of a system of instruction.

The establishment of the Industrial Educational Association in New York and the founding of the Manual Training School at No. 9 University Place, which has since developed into the College for the Training of Teachers, had a wide influence in that part of the country. Very soon after this association got to work a similar one was organized in Hoboken, known as the New Jersey Industrial Educational Association. Leading superintendents and teachers in the State began to investigate and discuss the subject in State and county association meetings. An impetus was given to the work at the meeting of the State Teachers' Association at Trenton, where an exhibition of all kinds of school work was displayed, in which drawing, manual training, kindergarten work and kindred occupations were marked features.

Inasmuch as the State had shown a disposition to foster industrial education, which had resulted only in the establishment of one technical school, the leading schoolmen of the State influenced the Legislature to enact a law designed to extend State aid to all localities interested in organizing manual training in the common schools. By an act approved April, 1887, it was provided that, "Whenever, in any school district in this State, there shall have been raised by special school tax or by subscription, or both, a sum of money not less than one thousand dollars for the establishment in such district of a school or schools for industrial education, or for the purpose of adding industrial education to the course of study now pursued in the school or schools of said district, there shall be appropriated by the State, out of the income of the school fund, an amount equal to that appropriated by the district as aforesaid," etc. In 1888 this law was amended, and the amount to be raised by the district in order to entitle it to an appropriation from the State was reduced to five hundred dollars. This amendment has served to make it possible for some of the smaller and poorer districts to avail themselves of the benefits of the law. Already a number of school districts in the State have taken advantage of these laws, and others contemplate doing so. Montclair, Paterson, Vineland, Morristown, Orange, Elizabeth and other places have already complied with the provisions of the law, and have received an appropriation from the State school

fund in aid of manual training. It is now taught in those districts as a part of the public school curriculum. That it is abundantly successful cannot be questioned, for the testimony to its success is unanimous on the part of the teachers and school officers who have studied the principles on which it is based, and watched its results.

The city of Paterson was one of the first to take advantage of the new law. In the fall of 1887 the subject of manual training was brought to the attention of the board of trade and to the citizens at public meetings, and a joint committee was appointed, which raised the sum of $2,000 by subscriptions, thus insuring an additional $2,000 from the State. A joint committee of the subscribers and the board of education established a manual training school for wood-work, open to boys of the high school and the two upper grammar grades. In addition to this, a teacher of mechanical drawing was appointed for the high school, a director of drawing for the whole city; and a part of the funds was appropriated for drawing materials and kindergarten supplies, which had previously been taken from the general school appropriation. This was a significant fact, and its approval by State authority was a recognition of drawing and kindergarten as integral parts of a system of manual or industrial education. To confirm this principle, the law of 1888, above quoted, was passed.

I am informed that each year since my leaving Paterson, in 1888, the city has appropriated $1,000 in addition to the usual school funds, and that the State has contributed a like sum. This amount has been used in the payment of salaries, the original fund having been sufficient to meet the running expenses of the department. Nothing has been added to the original plan.

I have been informed by the State board of education, in a letter from which I quote, that in the fiscal year ending Oct. 1, 1891, the sum of $11,454.66 was raised in various localities in the State for the purpose of introducing manual training instruction in the common schools. An equal sum was paid to these localities by the State. The several localities and the sum raised by each for this purpose are as follows: West Hoboken raised $500; town of Union, $554.66; South Orange, $1,000; District Number 5, Essex County, $500; Garfield, $500; Vineland, $1,000; Paterson, $2,000; Hoboken, $2,000; Montclair, $1,000; Orange, $1,900; Morristown, $500; total, $11,454.66.

During the present year a largely increased draft will be made upon the State school fund for manual training instruction. Not only have the cities of Camden, Elizabeth and Atlantic City introduced manual training, but fifteen rural districts have done the same thing.

Inasmuch as any school, rural or urban, must raise not less than $500 in order to receive any State aid at all, you will see that not less than $20,000 will be raised in the State of New Jersey during the present year for manual training, and an equal sum will be drawn from the State school fund.

Both of the institutions under the control of the State board of education have manual training included in the curriculum. In the School for Deaf Mutes manual training is taught largely for its value as a basis for technical instruction later; the reasons for this are obvious. In the Normal School, however, manual training is taught for its educational value alone. Both form study and drawing and mechanic arts constitute independent departments of instruction, and a professor is assigned to each. There is no standing committee of the State board of education on manual training, but all matters relating to it are referred to the committee on education, which has charge of all the details of school administration. You will therefore see that, while there has been no legislation to enforce manual training in the public schools, the method taken to encourage it has been remarkably successful.

A letter from the superintendent of schools in Orange will speak for the work in that city, and is as follows: —

We raised by special tax in our city, in 1890, for the year 1890–91, $1,800, and received as much more from the State. The sum raised by any town or city by special tax, for manual training, in any amount from $500 to $5,000, is duplicated by the State. Last year we raised $1,900, and received as much more from the State. The amount expended in 1890–91 was $3,418.48. The fiscal year is just closing for 1891–92, and I have not the figures before me; but the amount spent for manual training is a little more than that of the preceding year. We had one additional teacher during the past year. The sum expended pays the salaries of three special teachers. Two of these are ladies, and give their whole time to the work. The instructor in carpentry teaches two days in the week. The expenditures besides are for rent of six rooms, steam and gas, material for the parqueterie, sewing, clay work, drawing books and pencils, carpentry, cooking, and new tools. All grades in all the schools have the training in some form. Drawing is in all the classes, from lowest primary to the last year in the high school. The weaving and parqueterie and clay are also in the primary grades. Sewing begins in the upper primary and extends through the grammar course. Wood-work, begun by second grade of grammar, is given to the third and fourth grammar, and all the high-school boys. Cooking is taught to the high-school girls of first and second years. The time of lessons at the shop is from forty-five minutes in younger grades to one hour in the older, one lesson weekly. The cost of our plant was $3,008.36. After three years' use, it is nearly as good as new.

Extracts from a report of a special committee on manual training of the New Jersey board of education may be of interest: —

We would especially emphasize the necessity of recognizing the great distinction which exists between manual training, as the term is used by educators, and trade teaching. Manual training is not trade teaching, but is as purely educational in aim and method as is the instruction in the older elementary branches by the side of which it is rapidly taking its place. By manual training, when properly used, is meant the training of the pupil's powers of expressing thought by delineation or drawing, and by construction or making. In sound educational practice the pupil will always be taught to connect words and names with the processes and things which they designate and symbolize. Manual training recognizes this principle, and gives the pupil an opportunity to learn to express his thought in terms of things and objects themselves as well as in words, and it also provides a training for his judgment and executive faculty. The schools are at present training the memory and the power to reason, and — in an increasing measure — the fundamental power of sense-perception. Until they include manual training in their curriculum, however, they will continue to ignore those two mental powers whose co-operation is so important to practical life, — the judgment and the executive faculty.

We find that the term "industrial education" is used in a variety of senses, but more properly to designate an education in which manual training is incorporated. There are serious objections to the use of the word "industrial" in this connection at all. These arise in part from the confusion which exists in the popular mind between it and the word "technical," and in part from the fact that it is already applied to reform schools, to trade schools and to charitable institutions of various kinds. When it is used to designate an education which includes manual training, it signifies merely that the industries of the country are drawn upon for subject matter with which to train the pupil's power of judgment and his executive faculty, and to give him that development of his active powers by bringing him into contact with things, which will increase the value of his school training for the practical purposes of life. Even when used in this sense, the term "industrial education" is an indefinite and misleading one, and its use should be avoided.

It seems to us desirable also that the State board of education should lay down certain definite rules by which it will be guided in the future in approving or disapproving courses of study in manual training which come before it in accordance with the provisions of chapter 38, Laws of 1888, section 1. In our opinion, this approval should be withheld whenever drawing and form study is not adequately represented in the proposed course of study. It should also be withheld unless drawing and form study is supplemented by constructive work of some sort or grade. This constructive work might be represented by kindergarten or by clay work, wood-working, sewing or cooking. By establishing such a regulation as is here recommended, the intent of the law will be most efficiently carried out, and the interests of the school be best served.

In reply to questions put by the members of the Commission, Mr. Meleney said: —

I assumed the office of superintendent of schools in Paterson, N. J., in 1883. The kindergarten we established during 1885–87. There was no special appropriation for kindergarten, the teachers' salaries and the expense of material coming out of the general appropriation. It was not recognized as a separate department, but as an essential feature of the primary schools. In my judgment, there should be no distinction of grades and no recognition of the kindergarten as a department, but it should constitute a grade or grades of the primary school. To young ladies from the city normal training school, and other primary teachers who seem to be naturally fitted, we give instruction in the kindergarten system, by a trained expert, to fit them for this work. In addition to that, all the primary teachers in the city we instructed in the gifts, occupations and games, so far as they could be used in the primary classes. This instruction was welcomed by the teachers. I do not think that any other city in the State has established kindergartens.

"Is drawing generally taught in the New Jersey cities and towns?" Drawing has been introduced to some extent. In Paterson we were unable to do anything until the manual training fund was established. Newark, Elizabeth, Long Branch and Montclair, and I think Trenton, had done very well, particularly Newark under the direction of Miss Fawcett. Recently Jersey City has made some progress under Mr. Thompson.

"Was there opposition to manual training in Paterson?" No. The movement became a popular one. The board of trade championed it, and the public meeting at which the matter was brought to the attention of the people was a very large and enthusiastic one. The following year the city government made a special appropriation for it.

"Manual training for girls?" I do not know of anything in the line of manual training for girls, except sewing and cooking, in Orange and Montclair. In Paterson we introduced sewing into a few schools in 1887, and in the spring of 1888 the board of education formally adopted a system of sewing, and notice was sent to all the schools that teachers must be prepared to take up sewing as a part of the school instruction for girls in September following.

"Do you think that manual training interferes with the progress of other studies?" No, I do not. After considerable experience and very careful observation, I believe that manual training is a stimulus to the progress of the school in other directions. It adds interest to school, stimulates observation and thought, and furnishes another mode of expression.

Appendix K.

MANUAL TRAINING IN LONDON.*

At a meeting of the commission, Nov. 5, 1891, two teachers of manual training who were on a visit in Boston, Miss Nystrom of Sweden and Miss Chapman of London, were present by invitation and gave evidence in substance as follows: —

We are teachers of *sloyd* or *hand-craft* in London. We train teachers for this branch of school work; and during the last two years, in an institute of our own, we have tried our ideas and methods on large classes of children from neighboring high, middle and elementary schools

The form of sloyd we have observed here in America represents only a very small part of the Swedish system. When we speak of sloyd, we mean everything that can be done in schools by hand-work. There is nothing really fixed about the system. If you travel over Sweden you find in different localities the same principles, but different methods and purposes to suit varying local needs. In Sweden there are from fourteen hundred to fifteen hundred schools in which the system is carried on. The population of London is very nearly the same as that of all Sweden. Therefore, when we say that we have the system carried on in fourteen hundred or fifteen hundred schools in London, it is equal to the amount of work done in Sweden at the present time.

The main difference between the Danish and the Russian systems of sloyd on the one hand and the Swedish sloyd on the other is that in the latter we make complete and useful things, while in the two former we work exercises only, and pay little or no regard to the usefulness of the articles made. The Russian and Danish systems are a little nearer the trade-school idea than is the Swedish. We do not see why the two systems should not be amalgamated.

Our experience with the Swedish system demonstrates, we believe, that it is not very wise to require children to make a finished useful object every time without any practising exercises. We have been continually occupied with this question of making finished objects; and our

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* Report of the remarks made before the Commission by Miss Nystrom of Sweden and Miss Chapman of London on the teaching of sloyd.

observation has been that if a child is allowed to begin and make complete articles immediately, without some previous practice, he cannot be expected to produce very good work. This has been the stumbling block in the Swedish system.

Another defect in the Swedish system is the lack of mechanical drawing. In our school in London we carry on our wood-work with drawing. We have very simple and primitive drawings on the wood. The children draw forms on their blocks, and then work them out. In Stockholm drawing has been tried in only a few schools. Mr. Salomon, the director at Nääs, set his face from the beginning against drawing, considering it too difficult, and preferring to work from the model or pattern directly. For instance, in working to curved lines, as in a wooden spoon, the lines are soon cut away, and the worker is left to his eye and his model.

Being asked why the Swedes were so very particular about having every article they undertook completed, and why they rejected all mere exercises in their sloyd instruction, Miss Nystrom stated that in her opinion it was owing to their previous history as a people. In Sweden for hundreds of years they had had handy men making and perfecting things. During the long winter evenings they were making agricultural implements and doing industrial work. They did not have so much machinery nor so many technological schools as in other countries, but gave more time to hand-work than other people were able or willing to give. Hence it was a national habit to make useful things by hand-work.

The school at Nääs in Sweden is a training school for teachers. There are smaller schools of the same kind scattered all over Sweden. These have been started by Nääs graduates, and of course propagate the Nääs methods of teaching. Mr. Salomon, the director of the Nääs training school, prefers regular experienced teachers for his pupils, but in fact welcomes everybody who comes to learn, and grants certificates to all who do the work well. He has no permanent corps of teachers, but is himself permanent, and does certain parts of the teaching, particularly the lecturing on the principles of sloyd. There is really no instruction in drawing. If pupils like to use drawing, well; if not, well, also. The school is supported by Mr. Salomon's uncle, who is a wealthy man. It is resorted to every summer by teachers from all over Sweden and from many foreign lands.

When we started on our sloyd work in London, our efforts were directed to training classes of teachers, who gave up their summer holidays for the purpose. We soon found that the Swedish methods of work would require alteration to suit them to English needs and character. The models, too, did not interest the children. We have therefore made many changes, gradually feeling our way, studying very carefully all systems, observing particularly what has been done by our London school board, and endeavoring to gather good ideas from all sources. We have been much cheered by the amount of interest excited, especially among teachers, who in many instances at first were our most bitter opponents, but who afterwards expressed their warmest sympathy.

The children were interested from the first, and their interest has continued unabated.

As to age, our children range from ten to fourteen. We have not admitted any younger than ten. We hope, however, to work out an elementary series of wood-working exercises for younger children, and then we shall admit younger pupils than we do now.

The boys sent to us are generally picked boys from the board schools. During their absence from their regular classes their classmates go on with the regular school work. The boys are picked out by the masters, who usually send the boys that can best be spared, on account of their high standing. Occasionally they send boys who can best be spared on account of roguishness; and these we have found to be our best workers.

The length of our course we think ought to be three or four years, two hours a week from September to June; but oûr own school has not been quite two years in operation.

Regarding our manner of work, we begin with the knife and saw, which should be the first tools. We have class exercises from the beginning. Taking the saw, we explain its construction, answer all their questions, show them the right position to take in using it, and then let them practise on a piece of wood. Afterward each boy receives a piece of wood, and all taking the right position saw in time, — or try to. We use the curved motion in sawing, to avoid contracting the chest. We are exceedingly anxious to make use of the gymnastic exercises which we get from Copenhagen. It is very important that classes be started in the habit of standing properly. As every new tool brings into exercise a new set of muscles and requires new attitudes, only a very few tools can be introduced the first few weeks, if proper attention is paid to the attitudes. In the sawing, for example, the boys, having placed their boards in position and having taken the right attitudes, all saw first with the right hand, all in time; then, changing attitude and taking the saw in the left hand, again saw all in time. Thus every part of the body gets proper exercise. Working together in this way with a certain amount of competition, they attain much more precision. It is a sort of military drill. There is no idleness; everything is done quickly; and we expect our boys to be at their best all the time they are at work. They work always under directions, and are never allowed to take tools without permission.

With the knife we give a long piece of wood, and allow the boys to ask whatever questions they wish. They then practise in cutting, acquiring a good long cutting stroke; and we tell them to make whatever they wish. When we think they can cut well, we tell them what to do. We show them a model, and say we want one like it, so long and so wide. They have little memorandum books in which they note down the measurements. We have no "working drawings." Of course I can go to the black-board and make a rapid sketch of the object for them, but there is no need of drawing any plans or dimensions, — that comes later on. The first thing they make is a little towel horse. We allow them to cut the measurements on wood, but they do not go farther than they are told. If we find the majority of the class have finished, we take the

whole class farther along, letting those who are behind remember what they can, and get further instruction later.

The age at which children begin the drawing of objects on paper is about ten years. After a few weeks' instruction they can make simple mechanical (working) drawings. It is considered a waste of time to draw both on paper and on the wood; the latter is enough in most instances. The pupil's interest flags if he is required to do his drawing twice over; he is in haste to go on to the next model, and we let him do it.

The classes in our London board schools number from fifty to seventy pupils. There is no rule limiting the size of classes. The upper classes are smaller than the lower, because the boys drop out as they become old enough to work.

Efforts are now making to train the masters of the regular classes so that they may teach the manual training. It is expected that masters so trained will be able to manage and teach their classes in detachments of from twenty-five to thirty. A class of fifty-six could probably be taught in two equal detachments.

The London school board is holding classes for the training of teachers in wood-working twice a week at different centres. Only men are admitted to these classes, there being on the part of the board no intention of employing women for this kind of teaching. Men are considered to be much better adapted to the work. It is not proposed to introduce wood-working into the girls' schools, as the girls already have needle-work and cooking, and soon will have laundry work.

We have made some changes in the sloyd to adapt it to English children, who apparently work more quickly and less patiently than the Swedish children do. We hold our children to a high standard of accuracy. In all cases when a child is to make an article we show him one completed, take it apart and explain all the parts to him. This method appeals to that love of production which we all have, and arouses the ambition of the child to make an entire object, which would not be the case were he only allowed to make parts of an object. We favor the use of few tools rather than of many, believing that we can obtain greater skill in a given time in that way.

The London school board will have nothing to do with the "sloyd system," so called, but is doing a good deal for "hand-craft." This hand-craft (a word, by the way, we much prefer to *sloyd*) is a system which the board is working out in the London schools quite independently. It is more like the Russian shop work than Swedish sloyd. It is based on drawing from the very beginning, and the manual consists chiefly of exercises.*

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* Since this statement was made, full information as to the character of the wood-working in the London schools has appeared in a recently published book, entitled "Wood-work (the English sloyd), by S. Barter, organizer and instructor of manual training in wood-work to the London school board, and organizing instructor to the joint committee on manual training in wood work of the school board for London, the city and guilds of London Technical Institute, and the Worshipful Company of Drapers. With 302 illustrations. Preface by George Ricks, B.Sc. Lond. London:

There is at present very little printed matter available for the study of manual training in England The whole subject is in a tentative, experimental and unsettled condition. Everything depends on the development of teachers. Mere artisans cannot be the teachers of sloyd, for they know nothing of its educational aims. Regular teachers, on the other hand, seldom have the necessary skill to command the confidence of their classes. We have observed some unfortunate instances of teachers who have been rushed through the training classes, and then, with little or no experience in sloyd teaching, never having been required to reproduce unaided and on their own responsibility the work they had been taught, placed in positions as fully competent teachers. We are likely to suffer from too low an estimate of the mechanical skill necessary for regular teachers to acquire in order to become good teachers of sloyd; just as we have suffered from underestimating the teaching skill that an artisan should possess for the same purpose. What we want is the easy facility of the artisan and the pedagogical knowledge of the teacher united in one person of high character.

Clay modelling and free-hand drawing ought both to be made parts of the course for training teachers. We are getting to be altogether too mechanical. We are not enough accustomed to judge of distances and dimensions without measurements. Every good teacher should be able to go to the black-board and make a rapid sketch of the object the class is making.

NOTE. — It is but fair to say that the above report has never been revised by the ladies who favored the Commission with their remarks, and that the stenographic report was somewhat confused and imperfect. To the best of my recollection and belief, however, the substance of what was said has been given accurately. — EDWIN P. SEAVER.

Whittaker & Co. 1892." This book conclusively shows that the work in "English sloyd" consists almost wholly of finished articles, and that mere "exercises" are very few in number The relation of this English to Swedish sloyd may be learned from these few words of Mr. Ricks in the preface: "The author of this book has invited me to write a short preface, doubtless partly because I have taken the most active interest in the introduction of manual training into public elementary schools as a necessary part of the school curriculum, and partly because I was the first to suggest the introduction of a modification of the Nääs sloyd into the wood-work classes conducted under the joint auspices of the city and guilds of London Institute and the school board for London, in which classes the author was a distinguished teacher. I gladly accept the invitation, for two reasons: (1) I am anxious to acknowledge to the full our great indebtedness to the Swedish sloyd. In his introduction the author points to certain defects in this system when measured by our special wants and changed conditions; but, nevertheless, the fact remains that, without the sloyd, we should probably have taken some years to work out such a scheme as that so graphically portrayed in the following pages.".

Appendix L.

MANUAL TRAINING IN ENGLISH SCHOOLS.

By Sir PHILIP MAGNUS,

Director of the City and Guilds of London Technical Institute.

Manual training is at length recognized * as a part of the English system of public elementary education. When we remember the opposition with which the suggestion that workshops should be introduced into British schools was met, we have reason to be satisfied with the progress which the movement in favor of manual training has made during the last few years.

It was in 1882 that the Royal Commissioners on Technical Instruction, impressed with the educational value of workshop training in the schools which they had visited in France, suggested in their preliminary report, that, by way of experiment, manual instruction might be introduced into a few of the elementary schools of England. In 1884, after they had had opportunities of further considering the beneficial effect of workshop training, they recommended in their first report that instruction in the use of ordinary tools should form part of elementary education, and should be subsidized out of State funds by means of grants, much in the same way as is the teaching of cookery and needle-work.

This suggestion met with considerable opposition and some ridicule, owing mainly to the incorrect views which prevailed as to the advantages to be secured by workshop instruction. We were told that the trade unions would object to the undue increase in the number of carpenters and joiners which would follow from the encouragement proposed to be given to the teaching of woodwork in ordinary schools; that the school was not the proper place for teaching trades; that slip-shod habits of work would be formed; and that the time devoted to literary instruction was already too short, and would be further curtailed by the introduction of a new

* In the year 1890.

subject into an overcrowded curriculum. Many even who favored the movement did so on the erroneous ground that the children of the poor were being over-educated, and that it was a good thing that they should learn a trade at school; and it was suggested that the trade to be taught should be that practised in the district in which the school was situated. The removal of these incorrect views was no easy matter. In 1886 Sir John Lubbock wrote an interesting article on the subject in the "Fortnightly Review," which was followed by a paper of my own in the "Contemporary Review," embodying the views I had previously expressed at the Birmingham meeting of the British Association. In the following year, in order to give the experiment a fair trial, the City and Guilds of London Institute, with funds placed at their disposal by the Drapery Company, offered to the school board for London the sum of one thousand pounds for the establishment of centres of instruction in the use of wood-working tools. They had previously made arrangements by which teachers of elementary schools might undergo a systematic course of carpentry instruction at their Central Technical Institution; and the number of teachers who applied for admission to the course was far greater than the workshops of the institution could accommodate. A joint committee was formed of members of the school board and of the City Guilds Institute; and the organization and direction of the instruction was left to this committee. The first question to be decided arose out of the selection of a teacher. There were some who urged that the most fitting person to teach carpentry was an experienced carpenter. Others pointed out that the object of the instruction was not to make carpenters, but to train the hand and eye, and that the best instructor would be a person skilled in the art of teaching and practically acquainted with the use of tools. The old battle had to be fought again between the advocates of manual training as a part of apprenticeship to a trade, and those who regarded it simply as an educational discipline, and as a necessary part of the elementary instruction of all children.

A very happy compromise was effected. Six centres were formed, three on the north and three on the south side of the Thames, and two very competent instructors were found, — the one a skilled artisan, who had distinguished himself as a science teacher in evening classes, and the other a trained elementary school teacher, who had gone through a course of carpentry lessons at the Central Institution. The experiment has proved most successful. The opposition to manual training as a part of school education has practically ceased, and a new era of elementary school teaching has been inaugurated. Ministers, statesmen, gov-

ernment officials and educationists have visited the centres and have seen the children at work, and have expressed their satisfaction with the value of the training, not only as encouraging a taste for handicraft, and helping to inculcate the lesson of the dignity of manual labor, but as an intellectual exercise and educational discipline. The success of the experiment verified the theories of every progressive educationist, from Locke to Huxley, and naturally assisted the Natural Association for the Promotion of Technical Education in their endeavors to obtain the recognition by Parliament of manual training as a part of primary instruction. The battle is now won. The new Code, which Parliament issued this year, and which regulates the State-aided instruction throughout the country, recognizes manual training as a part of public elementary education. It provides that manual instruction may be given in the school premises or elsewhere, and whether or not by the ordinary teachers of the school, and it suggests that manual instruction should be given in conjunction with drawing. The effect of this inclusion of manual instruction among the subjects recognized by the Code is that the cost of the instruction may be defrayed out of the ordinary school board funds derived from the rates. Previously no part of the general school fund could be applied to the provision of manual instruction, that subject not being recognized as coming within the parliamentary definition of public elementary education. In the circular which is issued as a guide to the inspectors in giving effect to the provision of the Code occurs the following important paragraph on manual training: —

> The difficulty which has hitherto prevented the recognition of manual training as part of the ordinary course of instruction in a public elementary school has been removed by the alteration in the terms of Art. 12 (f). In some foreign schools manual exercises in continuation of the employments of the kindergarten, and graduated in difficulty, are carried onward through all the classes of the school, and are found to be not without a useful reflex influence on all the ordinary school studies. Such exercises sometimes consist of modelling, the cutting, fixing and inventing of paper patterns, the forming of geometrical solids in cardboard, and the use of tools and instruments. Although no special grant is made by this department for such instruction, you will watch with care the working of any experiment which is made in this direction, and will report upon it.

The use of the expression "this department" was thought to imply that the department of the committee of council on education, which has the direction of scientific and technical instruction, and is known as the "science and art department," might be

enabled to make especial grants from the imperial fund in aid of manual training; and this expectation has been fulfilled. The science and art department, in the directory for 1890, offers, under certain conditions, a grant of six shillings or seven shillings, according to the quality of the work done, for every scholar in a public elementary school who is receiving manual instruction, provided that the instruction so aided is: (*a*) in the use of ordinary tools used in handicraft in wood and iron; (*b*) given out of school hours in a properly fitted workshop; and (*c*) connected with the instruction in drawing; that is to say, the work must be from drawings to scale previously made by the scholars.

A note to clause *b* explains that the expression "out of school hours" means only that the manual instruction shall be in addition to, and shall not be taken out of, the minimum of twenty hours per week to be given to the teaching of other subjects included in the Code. It is, however, a condition for obtaining the grant from the imperial funds that each scholar shall have passed the fourth standard, and shall have received manual instruction for at least two hours a week for twenty-two weeks during the school year.

As regards the advantage of associating manual instruction with drawing, every one is agreed; but difference of opinion exists as to the advisableness of insisting on a minimum of two hours' instruction a week. In many places, notably in Liverpool, where manual instruction has been successfully given, it has been found that a lesson of one hour and a half, once a week, is sufficient, and efforts will be made to obtain a modification of the rule on this point.

It will be seen that the legislation of this year enables the school board rates to be employed in defraying the cost of manual instruction, and also provides grants from the imperial funds in aid of such instruction. The latter subvention is most important, for without it manual instruction might have been restricted to the board schools, in which less than one-half of the children of the people are educated. The voluntary or denominational schools receive no aid from the rates, but they equally with the board schools obtain grants from imperial funds. Not only, therefore, is manual instruction recognized by the new Code as a part of elementary education, but the teaching is directly subsidized by the State.

Appendix M.

MISCELLANEOUS MATTERS.

Boston Manual Training Course.

Class III. (*First Year.*)

1. Clay modelling of sphere, cube and cylinder, and of familiar objects approaching these types (*e. g.*, apple, nest, basket, box, house, stove, bottle, rolling-pin, muff) ; also of hemisphere, square prism and triangular prism, and of familiar objects approaching these types (*e. g.*, bowl, spoon, saucer, cake, brick, steps, cradle, boat, stool).

2. Paper folding and cutting of faces, edges and sections of the above-named solids, in blue, red and yellow papers, carefully measured and divided, with study of squares, circles, angles and lines.

3. Sewing in colored threads (blue, red, yellow) on coarse cloth or canvas (stitches over and under, counting threads), in vertical, horizontal and oblique lines, the same in parallel lines, and in outline forms, as in paper folding.

4. Stick laying, preceding, and conformed to, the regular drawing lessons for this grade.

Class II. (*Second Year.*)

1. Clay modelling of the ovoid, ellipsoid, cone and square pyramid, and of plant and animal forms approaching these types (*e. g.*, leaf, petal, corolla, seed vessels, heads and trunks of various animals, bills of birds, eggs).

2. Paper folding and cutting, in colored papers (red, blue, yellow, orange, violet, green), of plane figures made by sections of the above-named solids, and of plant and animal outlines approaching these types (*e. g.*, leaf, sections of fruit, flower, seeds, star-fish, shells) ; also of bilateral and radiate designs based upon these, for decorative work.

3. Sewing on canvas, with colored threads, on the same lines of development as in the paper cutting.

4. Stick laying, preceding, and conformed to, the drawing lessons for this grade.

Class I. (Third Year.)

1. Clay modelling of symmetrical designs on plaques, and of plant and animal forms in relief on plaques, or as models for art.

2. Paper folding and cutting in all colors, tints and shades, for harmony of color and beauty of design; also in bilateral curves conformed to the drawing lessons for this grade.

3. Sewing on soft cloth, in colored worsteds, for harmony of color, beauty of design and free use of curved lines.

4. Light card-board construction work, modifications of type forms, for use or beauty; representations of toys, utensils, furniture, etc., with the use of glue.

Manual Training Course laid down by New England Superintendents' Association.

First Year. — Clay modelling typical forms, corresponding forms in nature; paper folding and cutting; stick laying; sewing; drawing.

Second Year. — Clay modelling; paper folding and cutting; peas and sticks; drawing.

Third Year. — Clay modelling; paper folding and cutting; cloth and card cutting; drawing; color.

Fourth Year. — Clay modelling; paper, card-board and cloth; sewing on card-board and cloth; color.

Fifth Year. — Clay modelling on tiles and maps; paper and card-board construction; drawing; sewing; color.

Sixth Year. — Clay modelling; paper, card-board and soft wood; drawing; sewing.

Seventh Year. — Clay connected with science and geography; drawing; sewing; cooking.

Eighth and Ninth Years. — Clay; wood-work (sloyd); drawing.

Manual Training Exhibit from Washington Schools.*

The exhibit from the public schools of Washington, D. C., represented form study as developed through clay moulding and

* From "A Conference on Manual Training," printed by Geo. H. Ellis, Boston, 1891.

carving, stick laying, paper folding and cutting, construction of models in card-board and examples of design applied to needle-work, drawing and tool laboratory work in shops. The constructed forms and drawings were arranged in the order of their development through the twelve years of the school course, including high school and the normal training school. Both the constructions and the drawings were selected from the regular school work of the pupils, which represented the courses of work actually in operation as far as they could be represented by an exhibit.

First Year. — Geometric solids, together with a variety of objects suggested by these forms, were shown in clay. No drawing was shown in this connection. (The use of the pencil at the beginning of the first year is confined to drills for securing correct position and correct movements for drawing straight and curved lines.) The study of the edges of the solids made in the grade was shown by constructions with sticks of different lengths, defining both the geometric forms and invented combinations of them. These were represented by drawings. The planes, squares, oblong rectangles, triangles, with invented combinations of the same made in folded colored paper, were shown, drawings of the same being given.

Second Year. — Forms were shown in the same materials as those of the first grade and in the same order, those in clay being of increased size and of greater variety. In stick laying the rhomb was contrasted with the square, and the rhomboid with the oblong rectangle, etc. The sticks were used also to develop ideas of length and of the division of lines. This work was represented by drawings. The paper folding of this year involved all the geometric forms having right lines, including original combinations, primary colors and their tints being used. Drawings of these forms were given.

Third Year. — The forms in clay were larger than those of the first and second grades. The paper work was shown in cutting, consisting of units of design and their arrangement in squares, oblong rhombs, triangles and borders. This year was represented in drawing by drill exercises in straight lines and circles, top and front view of solids, representations of envelopes, fans, bottles, representations of the designs in colored papers.

Fourth Year. — The sphere, the ellipsoid and the ovoid were the geometric forms represented in clay. Based upon these forms were many fruit forms and forms of pottery of specified height, showing increased power in the use of clay. Paper cutting was shown, consisting of units of design and their arrangement in the

pentagon, the hexagon, the octagon and in borders. The pencil drill of this year was shown in the circle, the ellipse and the oval. The drawings were of forms above named, as well as of fruits and vegetables drawn from nature.

Fifth Year. — Working drawings and developments for geometric forms with the forms in card-board made from the working drawings were shown. Drawings of objects, the cylinder and the cone, and mugs, tumblers and other objects based on those geometric forms, were exhibited, giving their appearance as seen below the level of the eye. Leaf drawing from nature was an important feature of the work of this year, a great variety of leaves being shown. In decorative work these leaves were conventionalized and arranged in rosettes and borders. These were applied to outline embroidery. A few were cut in paper. In clay, ivy and other leaves were shown. Conventional arrangements of leaves and some historic forms, principally the lotus, carved in clay, were also shown.

Sixth Year. — Advanced working drawings, and their developments with models made from them in card-board, were shown. The drawings represented rectangular solids, in addition to drawings similar to those of the fifth grade. These were drawn from the constructed forms, single and in groups. Drawings from nature of leaves and branches, and decorative arrangements designed from these, were shown. Mouldings in clay of leaves and branches were shown, with some examples of historic ornament, moulded and carved.

Seventh Year. — Working drawings of this year made by use of instruments involving geometric problems were shown. Object drawings were of groups of geometric solids and various other objects based on them. The drawings from nature were leaves, branches and flowers. Decorative work consisted of bilateral arrangements of the foregoing. Applications of color to articles of use were shown in this year's exhibit.

Eighth Year. — Additional geometric problems and their applications to construction were shown, also drawings of objects in the school-room to scale, and complete working drawings of many small objects. Pocket-books made of leather, and numerous other useful articles, were exhibited. The object drawing consisted of groups of books, vases and other forms. Drawings from nature were flowers, from which the decorative arrangements were made. Many of these were applied to the embroidery of various articles. Mouldings in clay were groups of fruit, nuts, flowers and of historic ornament. Mouldings of some of the bones used in the study of physiology were shown.

Somerville Course.

Kindergarten. — Folding, sewing, weaving.

First Grade. — Sewing and clay modelling, illustrating lessons in natural science. Cutting, folding and free drawing, based upon the study of the sphere and cube.

Second Grade. — Cutting from free drawing, and drawings based upon the cylinder, square prism, hemisphere and triangular prism.

Third Grade. — Cutting and drawing based upon ellipsoid, ovoid, equilateral triangular prism, cone and square pyramid.

Fourth and subsequent grades indicate more definitely the three leading lines of drawing: namely, first, constructive; second, pictorial; and third, decorative, as follows: drawing of facts of type forms already studied; drawing of natural objects based upon sphere and ellipsoid; arrangements of type forms in paper; borders and surface covering.

Fifth Grade. — Drawings of facts of type forms and objects based on type forms. Pictorial drawings of natural forms and simple familiar objects. Arrangement in paper of units around a centre and borders.

Sixth Grade. — Drawings of facts of simple objects and patterns. Perspective of the cylinder and objects based upon the cylinder. In paper, arrangements of units to show by bilateral symmetry surface covering and drawing of simple forms of historic ornament.

Seventh Grade. — Top, front and end views of solids. Simple groups of objects, involving free-hand parallel perspective. In paper work, borders and all-over patterns, and simple forms of historic ornament.

Eighth Grade. — Drawings to show construction of more difficult objects. Groups of objects showing parallel perspective. In paper work, repetition of units to cover a vertical surface.

Ninth Grade. — Work in constructive drawing. Objects in angular perspective drawn. In paper work, simple designs from conventionalized plant forms.

Springfield Course.

Drawing was first introduced into the grammar grades of the schools in 1870, but was taught by the regular teachers. A special teacher in drawing was appointed in 1874. The Prang books were used in all grades for several years. In 1890 grades six, seven, eight and nine began working upon drawing pads, the work being prepared by the supervisor of drawing. The work in all grades at present is as follows: —

First Year. — Solids: sphere, cylinder, cube, hemisphere. Prisms: square, right-angled. Expression by moulding clay, cutting, drawing at board and on paper, pasting and sewing.

Second Year. — Review first-year solids, and study equilateral triangular prism, ellipsoid, ovoid, cone and square pyramid. Leaves. Expression as in first year.

Third Year. — Review from study. Prang's Shorter Course, Book 1, twice. Additional work on paper. Making in card-board.

Fourth Year. — Prang's Shorter Course, Book 2, twice. Additional work on paper, and making in card-board.

Fifth Year. — Prang's Shorter Course, Book 3, twice, or Books 3 and 4. Making in card-board.

Sixth Year. — Making in card-board. Paper. Natural leaves. Spirals, and curves upon which designs can be constructed. Historic ornament from copy. Designs, using leaves or ornament as motives. Appearance of cylinder, cone, cube, square prism, and common objects based on these solids, two faces showing. Fruit and vegetables. Working drawings, teaching use of three views. These views show foreshortened faces, invisible edges, sections, expression of dimensions.

Seventh Year. — Work done on blank paper. Study of natural leaves. Skeleton curves for designs. Designs using conventionalized leaves as motives. Historic ornament from copy. Appearance. Review work of sixth year, and teach cubes, prisms and plinths at 45°. Group solids; vegetables. Use of compasses. Essential geometric problems. Application of compass work to designing, working drawings and making in card-board.

Eighth and Ninth Years. — Work done on blank paper. Study leaves and flowers. Plant analysis in connection with designs. Drawing natural objects preparatory to science work in high school. Historic ornament. Mechanical drawing. Use of T square, triangles and drawing board. Making in card-board. Review working drawings. Teach use of scale. Working drawings of common objects, pupils taking their own measurements.

Motive of the Prang Manual Training Course *

The primary school work of the Prang course leads the little child (in most cities and towns, under present conditions, he is fresh from home and street, with no previous helps in mastering himself and the world) through the study of type forms into

* Paper by Mrs. Mary D. Hicks.

direct and happy familiarity with things having form, and so into the possession of clear and correct concepts of form. This study of type forms is carried on in close connection with the study of kindred forms in nature and in art; and, developed progressively in accordance with the well-known law of opposites and their mediation, which is the law of harmony in art as well as in the kindergarten, gives the child, during his first two or three years of school life, such mental grasp of his environment as serves him well in all later work. Here, too, in the earliest primary grades, is begun that free expression of individual thought and feeling which characterizes the educational use of art processes, — language, building, clay modelling, tablet and stick laying, paper folding and cutting, free drawing, the use of color materials, — all these are utilized as simple and practicable means for the outward expression of inward activity. And it is not found difficult, in this most elementary work, to awaken in the children the beginning of a true art feeling, and to lead them to put such feeling, crudely but truly, into their own modelling, drawing and making.

It is easy to see how this department of primary school work touches every other department with its wholesome and happy spirit. Language, number, elementary science, nature study, simple calisthenics and motion songs, all find themselves related to this primary work in form drawing and color, and helped by it to an extent which only the wise kindergartner could have fully predicted.

The work of the Prang course, in grades above the primary schools, is logically based on that of the earlier years. Dividing naturally into the three inter-related subjects of constructive drawing (drawing as related to construction and the industrial arts), representative drawing (drawing as related to pictorial art) and decorative drawing (drawing as related to ornament), it develops consistently and naturally along these three parallel lines, being closely related, all the way through the grammar school, to the contemporary work in arithmetic, geography, natural science, history and literature. Children are led, as early as may be, to confirm their previously gained concepts of form by working, in certain exercises, from these mental concepts alone, rather than from tangible, material things; letting the imagination recreate the thing, and express its own creation by modelling, making or drawing. And again, as the course of study develops, more attention has necessarily to be given to technique. Ideas of beauty should have beautiful expression, and the ability to express beautifully must be acquired through patient practice under wise direction. From the fourth and fifth grade upward, provision has therefore

to be made for excellence of rendering as well as freedom of expression, much free drawing being naturally and helpfully done in connection with other school studies. The aim throughout the course is the cultivation of the power to think form clearly and correctly, either with or without the sight of objects possessing form, and to express, with truth, simplicity and beauty, both those ideas of form which are directly gained from the observation of nature and art, and those which are the flower of the creative imagination. Abundant evidence already shows that this foundation of form study, this systematic primary-school practice in the elements of hand training, followed up as it is in the higher grades by exercises in reading and making working drawings and the actual construction of objects with constant regard to the art principles involved, gives school children sound and satisfactory preparation for the special instruction of the best manual training schools, or for intelligent entrance on industrial pursuits.

The training afforded by the Prang course along the lines of decorative art leads immediately and helpfully up to both spiritual and so-called "practical" service in daily life. Intimately connected as it is with all the industrial arts, its utilitarian value hardly needs exposition. It is only when one considers the significance of a crude or a cultivated taste in the choice of things of daily use that one begins to realize the import of educating the taste of a whole generation of children.

Course of Instruction in Sewing laid down by New England Superintendents' Association.

First Year. — Folding; basting; back-stitching; overcasting; hemming; proper wearing and use of thimble in connection with needle; right length of thread, threading needle and making knots; holding of work by left hand; position of work and needle taught in connection with stitch given, also beginning, joining and fastening of thread. Stitches should first be drawn upon paper, using the ruler to insure accuracy of stitch. Hems, wide and narrow, may first be turned upon paper, using the ruler for a measure. Each new stitch should be preceded by a drill in the proper position of the hands and fingers while making the stitch; also a drill for the arms in the motion of drawing the needle and thread through the cloth. Models: articles brought from home may be towels, napkins and handkerchiefs to hem.

Second Year. — Review previous year's work; overhanding on folded edges; overhanding on selvages; wide hems; plain fell; darning tear; running, especial drill given in the position of the

fingers in making this stitch, also teaching the pupils to use the side of the thimble. Models: a pillow slip, plain apron without gathers, or small sheet.

Third Year. — Review previous year's work; gathering, laying or stroking gathers, putting gathers into band by back stitching and hemming; French fell, straight fell, reversible seam; darning tear with silk; patching on cotton cloth; button-holes commenced, four-holed buttons sewed on; feather and herring-bone stitches; the proper way of tearing or cutting cloth for bands or ruffling, viz., straight or across the grain. Models: apron with band, plain white cotton or flannel skirt with band, button-hole, and button sewed on.

Fourth Year. — Review button-holes and sewing on buttons; putting in gussets; darning tear with ravellings; patching on calico and woollen goods; stocking darning; cutting bias bands and joining same; tucking and ruffling. Models: some garments to be made, combining the stitches learned and teaching the cutting and putting together.

Suggestions: in all grades particular attention should be given to the position of pupils while sewing. Accuracy of rule and measure is to be insisted upon. Soft, half-bleached cotton cloth and colored thread may be used for practice work, the colored thread showing the shape and size of the stitches better than white.

Materials for practice work for one pupil for the first year are as follows: one-half yard of half-bleached cotton cloth; one spool red cotton, No. 50; one spool blue cotton, No. 50; one spool yellow cotton, No. 40; thimble, pinball and sewing bag made from one-half yard of calico, with owner's name sewed upon it.

Philadelphia Sewing Course.

Fifth Grade. — Position of the pupils while engaged in sewing; the proper use of the thimble finger, first finger and thumb of the right hand; position of the left hand for holding the work; drill in the same; exercises in the action of taking a stitch and drawing the thread through the material; drill in the threading of the needle (needle and thread may be given out at the beginning of the lesson); turning, basting and sewing plain hems (attention to be given to accuracy in width of hems and size of stitches used in basting and hemming); correct use of scissors (paper may be supplied for this purpose); overseaming on turned edges (the raw edges may be turned in and hemmed down). If more material is needed than that furnished by the Board of Education, towels, wash-rags and similar articles may be hemmed.

Sixth Grade. — Questions and exercises in the use of thimbles, scissors, threading the needle; the direction of the needle, as used in basting and sewing a hem (time for these exercises, five minutes); overseaming with explanations and exercises in joining a new or broken thread; running seam, composed of one running and one back stitch, the raw edges to be overcast; cutting out and making simple articles, *e. g.*, children's bibs, plain over-sleeves. Work brought from home may be table napkins, towels, bags, desk covers and pillow slips.

Seventh Grade. — Questions on position, the proper use of the thimble and scissors; exercises in threading the needle; questions on the direction of the needle when used in basting, hemming and overseaming (time for this exercise, five minutes); reversible seam; plain fell, sewed with running stitches, strengthened by an occasional back stitch and finished by hemming; back-stitched seam overcast on the raw edges; patching commenced; cutting out of plain under waists without seam under the arm. Work brought from home may be towels, table napkins, pillow slips, ruffles to hem, bags and worn articles that may need patching.

Eight Grade. — Questions on the work of lower grades (time for this exercise, five minutes); plain fell repeated; gathering, placing or stroking the same; sewing the gathers into a band, using half back stitching, the band finished with hemming; darning commenced; work to consist of stocking and dress darning; cutting out patterns of under waists and aprons of all kinds. Work brought from home may be aprons, under waists, combing towels, shoe bags, ruffles to hem and gather, darning and mending.

Ninth Grade. — Narrow hems, hems of medium and broad widths; tucks (threads should not be drawn from the material to secure straight tucking); narrow, plain fells; French fells; fine gathering, hemmed to a band; button-holes; gussets; shirt or other four-holed buttons sewed on; stocking mending and patching; cutting out and making drawers from actual measurements. Shoe bags, sleeves, aprons, muslin skirts and plain undergarments may be brought from home to be made, and kept in school until finished.

Tenth Grade. — Bias seams of all kinds; gathering, as done on dress skirts, to be overseamed to a band; the two stitches used on flannel undergarments, viz., herring-bone stitch and feather stitch; button-hole; cutting out and making gored skirts. Children's plain underwear, boys' shirt waists, collars and cuffs, dusting caps and plain flannel skirts may be supplied from home.

Eleventh Grade. — Questions and review of all work done in previous grades; paper patterns drawn and cut for undergarments

from actual measurements; material for such garments brought from home and cut out in school; pupils taught to place the patterns properly and economically on the muslin; work basted and fitted on the pupils.

Twelfth Grade. — Review of all work done in previous grades; pupils should be required to decide which seams should be used for the several parts of the garments cut and made in this grade; first steps in dressmaking; method of basting lining and material together for dress waists and sleeves; trying on and fitting the same; adjusting facings to lined gored skirts; sewing on braid, etc. Mending of all kinds must be encouraged by the teacher.

BROOKLINE SEWING COURSE.

Fourth Year. — Threading needle; use of thimble; exercise of thimble finger; position of needle against thimble, and pushing through cloth without thread; use of scissors; first stitches learned on canvas with worsted; basting; stitching; back stitching, turning, basting and sewing hems; oversewing turned edges; beginning and joining of thread for these different kinds of work; questions on year's work.

Fifth Year. — Position while sewing; review of last year's work; work done on pieces of unbleached cloth, nine inches by three inches, and all seams sewed with three colors of cotton, to show joinings; two pieces of cloth basted together; stitching below basting; hemmed fell, turned with needle; running stitches, needle remaining in cloth throughout entire length; one-inch hem turned, basted and sewed; button-hole practice commenced; edge of cloth turned straight and oversewed to hem; running and back-stitched seam cut evenly and overcast; French seam; fell, the hem being turned with the needle; patch prepared, basted and hemmed on; patch prepared, basted, stitched in and overcast; oversewing selvage edges; gusset set into selvage seam; tucks measured, basted and run; stroking; sewing into binding; questions on year's work.

Sixth Year. — Exercise of scissors on striped and checked cloth (stripes train the eye for cutting by a thread in fine cloth); exercise of thimble finger; button-hole practice (cross bar on outer edge in overcasting and straight bar on inner edge in finishing, — every part of button-hole work represented on black-board); darning of all kinds, — in stocking goods (hole darned on wrong side, small loops left to allow for shrinkage), in fine cloth, in worsted fabric with ravellings, in silk and satin with ravellings of same, in table linen with fine linen floss; learning number of

needle and number of cotton used for different kinds of work; sampler commenced (the sampler is made of fine white cloth, carrying out in cotton the instructions given in lower grades on coarse cloth with colored cottons); cross-stitch made on canvas with worsted; questions on the year's work.

Seventh Year. — Sampler continued; single and double feather-stitch on canvas with worsted; herring-bone stitch on canvas with worsted (both represented on black-board); herring-bone stitch with silk on flannel; feather-stitching with silk on flannel; button-holes, different sizes, on sampler; button-hole with twist on flannel (button-holes cannot be practised too much); gathering, stroking, sewing on band; sewing on buttons; gusset made; sampler finished; hemstitching; Mexican work on linen; alphabet in cross-stitch, on scrim, with silk; length, width and bias of cloth taught in this grade; questions on year's work.

Eighth Year. — Embroidery darning; embroidery button-hole stitching, couching, French knot; outline stitch; outline upon original designs; advanced drawn work; harmony of color; primary cutting (drawers) by measurement from black-board; intermediate cutting (skirt and sleeve) by measurement from black-board; finish piece of work from this instruction for exhibit; questions and review of work done in lower grades; questions on year's work.

Ninth Year. — Study of proportion of human form for cutting and fitting dresses; talks on dress materials; calculation for amount of material, of different width goods, needed for waist, skirt, sleeves, etc., proper kind of lining for different dress materials; matching of plaids and stripes; first steps in dress cutting; pin paper to model of girl's form, and cut out pattern; pin on sarcenet, or thin cambric, and cut out pattern; pupils taught to fit dress lining to each other; pupil taught to represent in colored paper (from book of models) a perfect pattern of dress she wishes to make (this instruction leads to knowledge of designing); dress cut and made (much of this work can be taught from black-board; make it class-work as much as possible); gored skirt drawn and cut by measurement; questions on year's work; review of instruction given in lower grades.

Cookery Lessons.*

Lesson on the Fire.

Before we cook anything we should learn how to make and attend to a fire, as, no matter how well the materials are pre-

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* By Miss Duff.

pared and put together, unless the heat for cooking is what it should be the results will not be successful.

To make a fire we must have something to burn, — paper, wood, coal, oil, gas, candle, etc., — in short, we must have fuel, which means anything that is used for burning or for making a fire.

Pupils are shown a piece of wood, a candle, etc. Here is plenty of fuel, and yet there is no fire, so something besides fuel must be necessary. A pupil suggests lighting a match, and a little questioning brings out the fact that from the match heat may be obtained, — the second thing necessary for our fire, — to make the fuel hot enough to burn.

How shall we light the match? It is suggested that it be rubbed against something. At one end of the common match is a red substance, a preparation of phosphorus, and beyond this extends for a short distance a thin coating of sulphur, which is the name of the yellow substance, and the rest of the match is of soft wood. Which end shall we rub? We are told to rub the red end, which is rubbed against a piece of glass. It does not light; it must be rubbed against something rough; so a piece of sand-paper is tried, and it lights at once.

The rubbing of two substances together is called "friction," a word which means "to rub." Friction or rubbing always produces heat, and the rougher the surface the more friction, and the more friction the more heat. (Pupils rub hands together, and find that heat is produced.)

Had we rubbed the other end of the match against the sand-paper as much heat would have been produced, but we know from experience that it would not have lighted the wood, and we know also that if the red tip were broken off the sulphur would not light, either. We learn from this that some substances require more to make them burn than others. As the phosphorus preparation on the end of the match was rubbed against the sand-paper, enough heat was produced to light it, as it burns easily; and, as it burned, it heated the sulphur till it was hot enough to burn, and this in turn heated the wood till it also was hot enough to kindle.

The degree of heat necessary to make a substance burn or kindle is called its "burning point," or kindling point. Any substance which needs but little heat to make it burn (or a low degree of heat) is said to have a low "burning point," that is, it lights easily. We know that phosphorus must have a low burning point, and that sulphur has a higher burning point, and that wood has a higher still, because more heat is required to make them burn.

Ancient methods of obtaining heat are mentioned, — flint and steel, etc. A burning match is laid across a small box which rests

on the table, and while it burns freely a tumbler is put over it, close to the table. The match soon goes out. Another is lighted and placed in the same position, and the tumbler again placed over it and allowed to remain until the flame is almost extinguished. The tumbler is then raised, and the flame burns freely. This is repeated, and each time the tumbler is raised the flame starts up, and goes down when the tumbler is lowered. It is plain from this experiment that the tumbler shuts out something that is quite as necessary to our little fire as fuel or heat, and that is air. The air that is all about us is a mixture of two gases, four parts nitrogen and one part oxygen, which is the life-giving part of the air, — the part that is needed to keep our fire burning, and the part that animals breathe to keep them alive.

We have learned, then, that three things are absolutely necessary to make our ordinary fires burn : —

First. — Fuel, or something to burn.

Second. — Heat, to make fuel hot enough to burn.

Third. — Air, to keep fire burning, or to "support combustion."

We could make a fire out of doors, aud use various means to hang kettles, etc., over it, but it would be neither convenient nor safe to do so in the house, without some method of enclosing it, and it is also necessary to regulate the supply of air, as more or less heat is desired. Our fires are usually enclosed in iron boxes, which we call stoves ; and, as the conditions for making a fire in all enclosed spaces are the same, we will for convenience light a candle for our fire, and use a lamp-chimney to enclose it.

The candle is lighted and the chimney held over it a few inches from the table. It burns freely, so we know that there must be present the three things needed, fuel, heat and air. As there is an opening at the top of the chimney as well as one below, the question arises, Through which one does the air go in to keep the fire burning? Holding the hand above the chimney, we feel the hot air coming up against it, and when a feather is held over it it is blown upward, showing that the air which comes out at the top of the chimney is hot, and also that it rises, for even when the hand is held some distance above, the hot air may still be felt. Placing the hand at the opening below the chimney, we find that the air is no warmer there than in other parts of the room ; and, as there are but two openings, one above and one below, and we know that hot air comes out at the top opening, we think the cold air must go in below.

The chimney is lowered till it rests on the table, leaving no opening below. The candle soon goes out, though there is an opening at the top. We are sure now that the air which keeps the fire

burning is supplied from below. We have thus learned two things: first, that in our enclosed space the air to keep the fire burning goes in at the lower opening; and second, that heated air rises; and we understand why furnaces are placed in the cellar, and not in the attic.

Knowing that our stove must have one opening to let the air in, we will see whether any other one is necessary. The candle is once more lighted, the chimney being held a few inches above the table as before, and while our little fire is burning freely a piece of glass is laid over the top of the chimney, and in a very short time the fire goes out. There was plenty of space for air to get in, so, as the candle did not burn, we know that something more is needed, and we remember that when we held the hand over the chimney we felt hot air coming out, so the glass evidently kept in something that ought to get out. We have learned that it is the oxygen in the air which the fire needs to keep it burning, and we remember that when the tumbler was placed over the burning match it did not go out instantly. The air in the tumbler contained a certain quantity of oxygen, and the match burned until this was used up. When the oxygen is burned out of air what remains is really no longer air, but there is formed watery vapor, and a gas which is poisonous for animals to breathe and in which no fire can burn. We shall learn more about this later. (It is worth remembering that where a candle cannot burn a man cannot live, — a fact made use of in going down into unused wells. This poisonous gas is heavy, and sometimes settles at the bottom of wells, vats, etc. A lighted candle is gently lowered into the well, and if it continues to burn a man can descend in safety, otherwise he cannot until means have been used to get the gas out, as, if there is not oxygen enough to keep the candle burning, there is not enough for a man to breathe.)

The keeping in of this poisonous gas, then, is what caused our candle to go out; and we thus learn that in every stove there must be, besides a place for fresh air, or air containing oxygen, to get in, a place for the gases, etc., formed by the burning to escape. As the heated air, and the gases formed by the burning, — "partial products of combustion," — rise and go out at the top of the chimney, cold air is drawn in to take their place, and motion is thus produced, which is called a "draft." When the expression is heard, "The stove doesn't draw well," or "The chimney hasn't a good draft," it is meant that something prevents the air from going in freely, or that there is some reason why the gas, etc., cannot escape freely. The word "draft" means to "draw," and it is used here because when the heated air, etc., rises, cold air is really drawn in, sometimes with considerable force, to take its place.

Examining our stove, we find it to be a large iron box, with a space at one end lined at the sides with fire-clay, and the bottom is formed of iron bars with openings between, and we know this is the place where the fresh air goes in, and the same openings allow the ashes to drop through. This space is called the "fire box," because in it the fire is built. Outside the fire box, on the front of the stove, is a slide called the front damper, which may be opened or closed, as more or less air is needed. Directly behind and close to the fire box is another iron box, set into the stove in such a way that there is a space between the top of the stove and the top of this second iron box, which is really the oven; being smaller than the stove, a space is also left between the end of the oven and the end of the stove, as well as under and behind it. At the back of the stove, in the top, is an opening controlled by another slide, called the chimney damper, which controls the opening into the pipe which connects the stove with the outer air. This chimney damper and the front damper are the only ones absolutely necessary; but we find here still another damper, called the oven damper, the use of which we will now learn. Lighting a piece of paper, we notice that the flame is drawn directly across the top of the oven to the chimney damper. We will close the oven damper, and we find that the opening to the chimney through the chimney damper is closed, and the flame is drawn across the top of the oven, down the opening at the end, under the oven and up behind it, finally reaching the chimney, and we thus understand that by the closing of this oven damper the heated air is forced to go around the oven before reaching the chimney, and in this way the oven is heated. The arrangement of these dampers differs in different cooking stoves, but the principle is the same in all, — there must be a lower or front damper to control the supply of fresh air, and there must be a chimney damper to allow the escape of smoke, gas, etc.; and to heat the oven, the oven damper is necessary to force the heated air, etc., to take a longer course before reaching the chimney. When the fire is built all the dampers should be opened, allowing plenty of fresh air to go in; the chimney damper, to allow smoke, gas, etc., which goes off more abundantly when the fire is first lighted, to escape freely, and the oven damper, to allow the smoke, etc., to go off as quickly as possible. When the fire is burning freely the oven damper is the first one to be closed, that the oven may be heated.

To build the fire, paper, soft wood, hard wood and coal are generally used, shavings being frequently substituted for paper. The principle underlying the construction of the match is reviewed and applied to the building of the fire; paper, which is put into the

fire box first, crumpled to make more spaces, which, being filled with air, cause it to burn more freely; soft wood, which, having a higher kindling point than the paper, is heated to the necessary degree by the burning paper (the soft wood has coarse fibres rather loosely packed together, the spaces being filled with air when the wood is dried, while hard wood, having finer fibres more closely packed, has less air among the fibres, and so does not burn so easily as the soft wood); and the coal next, which, having a higher kindling point than either, must be heated by their burning to its kindling point. The wood must be arranged slightly crosswise, that the air may circulate around it, being careful at the same time to keep it close to the ends of the fire box, that the coal may not drop through the grate, and so not be kindled. When the coal is well kindled close the oven damper first, that the heat may be utilized, then the front damper and chimney, more or less, according to heat required. The latter damper is so arranged that, even though the slide on the outside of the stove is wholly closed, the opening inside cannot be entirely closed. If it could, ignorant or careless persons might close it, and the fire would not burn, or, if already burning, the poisonous gases would fill the room and much injury be caused to persons there, especially if sleeping. We also learn that after the fire has been burning long the ashes collect at the bottom of the grate and must be picked out with the poker, as otherwise the air could not reach the hot coals, and the fire would go out.

The Cookery of Starchy Foods.

Introduction: —

1. Foods containing starch more extensively used than any other.
2. Examples of these foods, — potatoes, oatmeal, rice, flour, corn, etc. (in nearly all vegetables and grains).

Necessity for cooking: —

1. To soften and dissolve the starch.
   - *A.* Makes it more palatable.
   - *B.* Makes it more digestible.

Experiment with starch: —

1. Starch subjected to heat alone.
   - *A.* Changes from white to yellow.
   - *B.* Changes from yellow to brown.
   - *C.* Changes from brown to black, — burned.
2. Starch subjected to water alone.
   - *A.* Starch and cold water, — does not dissolve.
3. Starch subjected to heat and water.
   - *A.* Changes from milky white liquid.
     - *a.* Grows thicker and clearer.
     - *b.* (When boiled) a clear, thick paste.

Explanation: —

1. This is corn-starch, — any starch will act in the same manner.
2. The composition of all starch is the same, the difference being only in the appearance and size of the granules.
3. Granules, — microscopic.
   - *A.* Appearance.
     - *a.* Irregular, wrinkled or folded membraneous sac (starch inside).
   - *B.* Effect of heat.
     - *a.* Dries and hardens.
   - *C.* Effect of cold water.
     - *a.* Starch is not dissolved.
     - *b.* Simply a mixture.
   - *D.* Effect of boiling water.
     - *a.* Starch absorbs water through membrane, swells, and finally bursts membrane, and is partially dissolved in the water.

Application of experiment to: —

1. Potatoes (composed of about three-quarters water and one-fifth starch).
   - *A.* Boiled.
     - *a.* Cooked until soft.
     - *b.* Removed at once, as boiling water partially dissolves starch, and the potato would become soggy.
   - *B.* Baked.
     - *a.* Water in the potato furnishes the moisture.
     - *b.* Starch absorbs the moisture when heated, and becomes soft. Potato is cooked.
     - *c.* Skin should at once be broken, to allow the steam to escape, because as the steam cools the water formed would make the potato soggy, instead of "dry and mealy."

Conclusion: All starchy foods need heat and moisture to cook them. If the vegetable or grain dees not contain sufficient, it must be added.

Summary: —

1. Review principal points to be remembered.
2. Additional knowledge.

Yeast.

Introduction: —

1. A good yeast cake known.
   - *A.* Light, even color.
   - *B.* Absence of dark streaks, — probably mould.
2. Yeast cake made up of thousands of tiny plants, each capable of increasing rapidly.

What yeast is: —

1. A plant, — one of the smallest and simplest forms of vegetable life.
    - *A*. Appearance. Like tiny cactus plant. (Teacher illustrate on board when explaining manner of growth.)
        - *a*. Transparent, oval cell.
    - *B*. Growth.
        - *a*. Conditions.
            - (1) Air, warmth, moisture and something sweet.
        - *b*. Manner. (Illustrate on board.)
            - (1) By budding.
            - (2) Very rapid, — can be seen.
    - *C*. Where obtained.
        - *a*. From froth of beer, usually, while fermenting.
    - *D*. Named a "ferment."
        - *a*. Ferments have the power to change other substances without being changed themselves.
    - *E*. Unfavorable conditions.
        - *a*. Temperature little lower than 212° F. kills it.
        - *b*. Temperature of 32° F. renders it torpid.

Yeast in bread: —

1. Why bread is kneaded first time.
    - *A*. To distribute evenly the little yeast cells.
    - *B*. To thoroughly mix ingredients.
    - *C*. To make the dough smooth.
2. Favorable conditions.
    - *A*. Air all about.
    - *B*. Flour, containing starch and gluten.
    - *C*. Warmth and moisture.
        - *a*. Lukewarm water, — why not cold?
3. Result.
    - *A*. Yeast plant grows. In growing the ferment causes the following changes: —
        - *a*. Part of the starch of the flour is changed into starch-sugar.
            - (1) Change not apparent.
        - *b*. Starch-sugar converted into alcohol and carbon di-oxide, — a gas.
            - (1) The gas (CO) in its effort to escape pushes up the dough, it is rendered porous and is said to have risen, — it is "light."
        - *c*. If dough is left undisturbed — another change — it becomes "sour" (lactic or acetic acid is formed, according to circumstances).
            - (1) This change prevented by baking.
4. Bread kneaded a second time when dough has doubled its bulk.
    - *A*. Breaks up large holes caused by gas bubbles.
    - *B*. Makes texture uniform and finer.

5. Bread baked.
   A. To cook the dough.
   B. To kill yeast plant, — "check fermentation."
   C. To drive off alcohol and carbon di-oxide.
   D. To make the bread eatable.
      a. More palatable.
      b. More digestible.

Summary: —
1. Review essential points.
2. Additional information about yeast, "wild germs," leaven, etc.

Baking Powder.

Introduction. Composition of baking powder: —
1. Present soda, name it, — cooking soda or bi-carbonate of soda.
   A. Measure definite quantity, — one teaspoonful.
2. Present cream of tartar, name it.
   A. Measure definite quantity, — two teaspoonfuls.
   Fact: twice as much cream of tartar as soda.
3. Give fact: baking powder is a mixture of soda with twice as much cream of tartar, with a little flour or corn-starch added to keep it dry.

Experiment: —
1. Mix in a tumbler one part soda and two parts cream of tartar.
   A. Effect when dry, — no effect apparent.
   B. Effect when wet with cold water, slight effervescence.
   C. Effect when wet with hot water, or subjected to heat and moisture, rapid effervescence, escape of gas evident.
   [NOTE. — Gas is the same as that in soda water of drug stores.]
      a. Gas named, carbon di-oxide.
      b. Commonly called carbonic acid gas.

Explanation. Facts given: —
1. Cooking soda is an alkaline substance, which contains a gas.
2. This gas is liberated by any acid substance. Proved by experiment.
3. Experiment.
   A. Soda and vinegar.
   B. Soda and lemon juice.
   Result: immediate effervescence, gas liberated.
4. Reasons for not using these acids in cooking.
   A. Rapid and immediate escape of the gas.
5. Teacher gives fact that cream of tartar is an acid substance, and its special value lies in the fact that it acts in but slight degree until heated.

Practical application of the use of baking powder in doughs, etc.: —
1. Biscuit. One pint of flour.
   A. Proportional of baking powder, two teaspoonfuls (measured rounding, on account of flour or corn-starch in the mixture of cream of tartar and soda).

- *B.* Water or milk, — cold, — why?
  - *a.* Slow escape of gas.
- *C.* Handling of the dough.
  - *a.* Warm hands.
  - *b.* Heat produced, gas escapes.
- *D.* Conclusion.
  - *a.* Handle as little as possible.

2. Baked biscuit examined.
   - *A.* Risen.
   - *B.* Porous.
   - *C.* Dough cooked.
3. Questions.
   - *A.* Where is the gas?
     - *a.* Driven off by heat of oven.
   - *B.* Why is it porous?
     - *a.* Puffing up of the dough by bubbles of gas in their efforts to escape.
     - *b.* Explanation of the tenacity of the gluten in the flour.
       - (1) Gluten grows tougher when kneaded, — a second reason for handling the biscuit dough as little as possible.
     - *c.* Heat hardens or cooks the dough before gas escapes, thus retaining the shape of the bubbles.

Summary: —

1. Review of things taught, and additional knowledge.
   - *A.* Composition of baking powder.
   - *B.* Proportion of soda and cream of tartar.
   - *C.* Why add flour or corn-starch?
   - *D.* Influence of heat, moisture and handling.
   - *E.* Proportion of soda and cream of tartar equivalent to given quantity of baking powder.
   - *F.* Equivalent proportions of soda and sour milk.
   - *G.* Equivalent proportions of soda and molasses.

Albumen, — Eggs.

Introduction: —

1. Albumen is one of the most valuable and nutritious ingredients of food.
   - *A.* Strength giving.
   - *B.* "Building-up" material.

Albumen: —

1. Principal sources.
   - *A.* Eggs.
   - *B.* Meat.
     - *a.* In blood principally.

   [NOTE — White of egg contains almost pure albumen.]

Experiment with egg albumen:—

1. Albumen subjected to the action of heat alone.
    - *A.* Is coagulated, becoming tough, hard and horny.
2. Albumen subjected to the action of water.
    - *A.* Cold water, albumen is dissolved.
    - *B.* Hot water,—134°-160° F. upward, but not to 212°,—albumen is coagulated, becoming of a tender, jelly-like consistency.
    - *C.* Boiling water rapidly coagulates the albumen, which becomes hard and tough.
    - [NOTE.—Coagulated albumen will not dissolve in water, hot or cold.]

Conclusions applied to the cookery of egg albumen:—

1. Heat alone will cook albumen.
2. Cold water dissolves albumen, will not cook it.
3. Water at temperature above 134°–160° F. but below 212° cooks albumen slowly, but renders it tender and jelly-like.
4. Boiling water cooks albumen quickly, but renders it hard and tough.

Facts,—albumen:—

1. Digestibility.
    - *A.* Uncooked, digests readily.
    - *B.* Cooked till tender, almost as readily.
    - *C.* Cooked till hard, digested slowly and with difficulty.
2. Flavor.
    - *A.* Improved by cooking.
    - *B.* Variety, according to degree of heat applied.

Summary:—

1. Review points taken
2. Value of eggs as food.
3. Manner of cooking them.

Albumen,—Meat.

Introduction:—

1. Albumen of meat found in blood and juices.
    - *A.* Value of juice as compared with rest of meat.
        - *a.* Contains much of the nutriment.
        - *b.* Contains nearly all the flavor.
    - [NOTE.—Never allow juice of meat to soak into wrapping paper.]

Experiment:—

1. Meat previously scraped and soaked in cold water.
    - *A.* Water colored red.
    - *B.* Meat is almost white, albuminous juice extracted and dissolved by cold water.
2. Water and albumen heated.
    - *A.* Red color changes to light brown, then darker.
    - *B.* Water becoming hotter, albumen separates as "scum."

C. Water boiled, separated albumen becomes harder, settles as sediment, leaving water almost clear.

3. Small piece of meat put into boiling water, temperature lowered after a minute, then meat allowed to remain eight or ten minutes.
   - *A.* Outside of meat hardened, color changed to light brown.
   - *B.* Water is not colored, no juice comes out.
   - *C.* Meat cut, inside tender and juicy.
4. Piece of meat put into boiling water and allowed to boil rapidly five minutes.
   - *A.* Meat hard and light-colored outside.
   - *B.* Meat cut, hard and tough all through.
5. Meat exposed to heat alone.
   - *A.* Intense heat at first, then lowered.
     - *a.* Outside rapidly hardened.
   - *B.* Meat cut open.
     - *a.* Inside tender and juicy.
6. Meat exposed to intense heat during entire time of cooking.
   - *A.* Outside hard.
   - *B.* Cut open, inside hard and tough.

Application to preparation and cookery of meat: —

1. Cold water draws out albuminous juices.
   - *A.* Wipe with damp cloth; never soak meat in cold water to cleanse.
   - *B.* Method of making, —
     - *a.* Beef tea, soups, broths, etc., obvious.
2. Boiling water keeps juices in by hardening outside rapidly.
   - *A.* Preparation of boiled meat.
   - *B.* Caution: long-continued boiling hardens the meat all through; it is tough and dry.
   - *C.* Best method: plunge meat into boiling water, and after outside is hardened reduce temperature of water.
   - Fact: Long, slow cooking in water makes tough meat tender.
3. Pupils apply principle to roasting meat.
   - *A.* Kind of meat for roasting.
     - *a.* Tender.
   - *B.* Intense heat at first.
     - *a.* Hardens outside and keeps juice in.
   - *C.* Temperature lowered.
     - *a.* Prevents hardening inside.
4. Broiled meat.
   - *A.* Hot fire, — hold close to fire at first.
     - *a.* To harden outside quickly.
   - *B.* Reduce heat, — hold farther away from hot coals.
     - *a.* Prevent inside from becoming hard and dry.
     - *b.* Attention to thickness of steak.
     - *c.* Only tender steak should be broiled.
       - (1) Long, slow cooking in water needed to make tough meat tender.

Summary: —

1. Review principles learned.
2. New applications.

*Lesson on Bread-making.**

Description of the yeast-plant. Composition of flour. Steps: —

1. Flour moistened.
2. Yeast added (ferment).
3. Dough left in a warm place (warmth assists fermentation).
4. Dough kneaded (to distribute CO_2 evenly).
5. Dough shaped.
6. Dough baked.
   - *A.* To kill the yeast plant.
   - *B.* To toughen gluten. Firm cell walls.
   - *C.* To expel CO_2, C_2H_5HO, H_2O.
   - *D.* To cook starch, albumen, etc.
   - *E.* To form crust, convert $C_6H_{10}O_5$ into dextrine and $C_6H_{12}O_6$.

Dangers: —

1 Too much yeast.
2. Too long rising.
3. Too little rising.
4. Insufficient baking.
5. Oven too hot.
6. Oven too cool.

If bread sours, the C_2H_5HO changes to $HC_2H_3O_2$, acetic acid.

Reactions: —

$C_6H_{10}O_5 = C_6H_{10}O_5$.

$C_6H_{10}O_5 + H_2O = C_6H_{12}O_6$.

$C_6H_{12}O_6 = 2C_2H_5HH + 2CO_2$.

$C_2H_5HO + O_2 = HC_2H_3O_2 + H_2O$.

Starch $C_6H_{10}O_5$. Alcohol C_2H_5HO.

Dextrine $C_6H_{10}O_5$. Acetic acid $H(C_2H_3O_2)$.

Dextrose $C_6H_{12}O_6$.

Yeast is a low form of vegetable life. It is made up of cells which keep dividing and subdividing, forming new cells. The yeast plant needs a warm, moist, sweet, nitrogenous soil. It is necessary in fermentation. Germs of this plant are in the air, and so, to keep preserves from fermenting, they must be air tight. The yeast plant grows by feeding upon nitrogenous matter, taking O from the air for its breathing, and by catalysis changing the sugar into alcohol and carbon oxide. If the yeast plant is growing too rapidly to get enough O from the air for breathing, it takes O from a little of the sugar present, and that sugar changes into glycerine, succinic acid, etc.

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* Girls' High School, Miss White's class in chemistry.

Flour is composed of starch, gluten, a little albumen, cellulose and a little oil.

1. The flour is moistened to give the molecule of water to the starch to make dextrine, and to make the flour tenacious so that it will hold the CO_2, and to help the yeast plant in its growth.

2. Yeast is added, to cause fermentation and make the bread rise.

3. The dough is left in a warm place, because warmth assists fermentation ; heat kills the plant, and it will not grow at all in a cool place.

4. The dough is kneaded to distribute CO_2 evenly. Some knead it as soon as it is made, others wait until it has risen. If you do the latter, you let the plant grow in masses, and then transplant it. If it is not kneaded enough, the holes are large in some places and small in others.

5. The dough is shaped just to make a pretty loaf.

6. The dough is baked to kill the yeast plant, toughen the gluten, expel CO_2, C_2H_5HO and H_2O, to cook the starch, albumen, etc., to form crust, and convert $C_6H_{10}O_5$ into dextrine and $C_6H_{12}O_6$.

In the crust the starch changes to dextrine, then to dextrose and then to caramel.

Too much yeast gives the bread an unpleasant taste ; too long rising makes it sour ; too little rising makes it heavy ; insufficient baking makes it unhealthy.

Course in Cooking.

A progressive course for public cooking schools, which may be more or less elaborated according to grade, includes making and keeping fire ; care of stove ; study of drafts ; study of fuel and waste ; care of kitchen and kitchen utensils ; setting of table ; serving at table ; care of dishes and linen ; care of closets, refrigerator and pantry ; care of diet and choice of dishes ; selection of meats and vegetables with reference to health, economy, variety and adaptation to the habits, the season or the market.

A logical sequence in the study and preparation of foods may be as follows : —

1. Study of cereals : how to cook each in water for gruel or mush ; how to make into breads.

2. Study of vegetables : how to cook in water and how to bake, roast or fry.

3. Study of fruits: how to serve uncooked, how to cook in water, how to bake, how to preserve, can and jelly.

4. Study of beverages: tea, coffee, cocoa, milk, water, lemonade, etc., how to make and serve.

5. Study of eggs: how to boil, bake, fry, mix and serve.

6. Study of fish: how to cook in water, roast, broil, fry and serve.

7. Study of meats: how to boil, roast, broil, fry and serve.

8. Making of chowders, broth, soup, stew, gravy, sauce.

9. Study of shell fish: how to cook and serve, oyster, clam, lobster, etc.

10. Making of pastry, pudding, cake and desserts.

11. Study of ferments and effervescents:* yeast, saleratus, cream of tartar, baking powder, beaten eggs and other chemical or mechanical agencies used in cooking.

Liverpool Training School of Cookery.

Syllabus of Laundry Class for Elementary Schools.

Lesson 1. — Demonstration: The process of disinfecting, and general rules for washing and drying table, body and bed linen, handkerchiefs, starched linen, silk, lace and muslin. Instruction in the use of soda, blue, melted soap, borax and ammonia, and information on the composition and action of these articles, and of alkalies and acids. Use of petroleum.

Lesson 2. — Practice: Practical application, by the children, of the work shown at the previous lesson, with questions on the theoretical instruction given.

Lesson 3. — Repetition of second lesson.

Lesson 4. — Demonstration: On mixing starch, hot and cold; cleaning and heating irons; management of fire; arrangement of ironing table; damping; folding; mangling; ironing.

Lesson 5. — Practice: Practical application by the children.

Lesson 6. — Repetition of fifth lesson.

Lesson 7. — Demonstration: On washing and drying flannels and woollen goods, both woven and worked, and silk; starching and ironing linen, print, lace and muslin; polishing iron; ironing and folding shirt.

Lesson 8. — Practical application by the children.

Lesson 9. — Repetition of eighth lesson.

Lesson 10. — Practice of the different processes without direction from teacher.

Two courses in cookery are given, — one in plain household

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* Such practical part of this subject as is necessary to bread making should be given with No. 1.

cookery and one in high-class cookery. A course consists of twelve practice lessons, ten in cooking and two in cleaning, with the corresponding demonstration lessons.

The ten practice lessons in plain household cookery will include: (1) Stock, roasting and boiling; (2) Soups, vegetables; (3) Bread and cheap cakes; (4) Fish; (5) Sick-room cookery; (6) Pastry; (7) Puddings; (8) Cheap dishes from tripe, fry, etc.; (9) Cold meat dishes; (10) Melting and clarifying fat, and the uses of macaroni, rice, curry and haricot.

The ten practice lessons in high-class cookery will include: (1) Stock, roasting, boiling; (2) Stewing, grilling, braizing; (3) Various ways of dressing fish; (4) Soups, vegetables; (5) Puddings; (6) Sick-room cookery; (7) Entrees; (8) Bread and cakes; (9) Pastry; (10) Jellies and creams.

School of Domestic Economy, Purdue University, Lafayette, Ind.

First Term.

Lectures. — Home-making; our kitchen interests; the art of cooking; bread making.

Practice. — Bread making, including yeast, ferment, dough; fermentation of dough, baking of dough, cooking and care of bread; graham bread, fancy rolls and twists, German coffee cake.

Lecture. — Boiling, simmering, stewing.

Practice. — Soup stock, beef tea, plain soup; boiling meats and vegetables; stewing meats and vegetables.

Lecture. — Broiling and roasting.

Practice. — Broiling meats and poultry; dressing poultry, larding; dressing meats and poultry.

Second Term.

Practice. — Making omelets and cooking eggs; cooking cereals and making coffee, tea and chocolate.

Lecture. — Frying.

Practice. — Frying oysters, ham, chicken, potatoes and mush; baking, boiling, frying and scalloping fish; making fruit, custard and English pies; making puddings and pudding sauces.

Lecture. — Mixing and seasoning.

Practice. — Making chicken, vegetable, and fruit salads; making croquettes, stews and hashes; setting tables and serving food.

Third Term.

Lecture. — Household management.

Practice. — Housework; laundry work; selecting meats and family supplies; handling milk and cream, making and taking care of butter; boning turkey and chicken; making cake; delicate desserts; making candy.

Lecture. — Social etiquette and usages of society.

Practice. — A high tea and sociable.

Drexel Institute of Art, Science and Industry.

Department of Domestic Science.

The course in domestic science is designed to give young women a liberal training in matters pertaining to the organization and management of the home. It provides courses in science, with experimental laboratory work. It gives scientific training in physical exercises, accompanied by careful instruction in physiology and hygiene. On industrial lines, it gives practical instruction in cookery, millinery, plain sewing and dressmaking.

The facts of chemistry, physiology, hygiene, etc., are correlated in a series of lessons under the name of household science. These lessons extend through the entire course of two years, running parallel with the other work, and showing its practical bearing in the conduct of life. There are also special courses in physiology, hygiene and sanitation, to which the public are admitted. The courses in cookery are supplemented by lectures on the chemistry of foods, and the dressmaking and millinery courses by lectures on the chemistry of textiles and dyeing.

The chemical and physical laboratories and the kitchens are well equipped with the newest and best appliances.

Department of Domestic Economy.

The course in domestic economy embraces the following topics:—

First Year. — Chemistry, cookery, millinery, physical training, English (literature and current events) and household science.

Second Year. — Physiology, hygiene and sanitation, dressmaking, decorative art, accounts, English literature and household science.

The fee is thirty dollars per term (five months).

The full course covers two years' work, but students may take a part of the course, and may elect from the foregoing list of studies such topics as they may desire, subject to the approval of the director of the department.

Pratt Institute, Brooklyn, N. Y.

Course in Domestic Science.

German; physics (energy and heat); chemistry (general, qualitative and quantitative); chemistry of foods; chemistry of cooking and calculation of dietaries; biology (bacteriology, physiology; emergencies (sudden illness, accidents, bandages, splints, poultices); hygiene (home and public); sanitary science; household science (ventilation, heating, lighting, water, etc.); household art (architecture, decoration, furnishing); home nursing (theoretical and practical); sewing; cookery; laundry; household economy (demonstration lessons in all branches).

Course of Lectures on House Decoration.

Lecture 1. — The Greco-Roman house: Origin of type; general aspect; mode of life; dress; style in forms and ornaments of furniture, etc.; the three styles of mural decoration; some general principles of mural decoration.

Lecture 2. — The mediæval castle: (*a*) Type fixed in early middle ages; stage of civilization it represents; character of ornament (Romanesque style) in mural decoration, furniture, etc., and dress. The castle in later mediæval times: (*b*) Character of ornament (Gothic style); importance of wood-work, and what good wood-work is.

Lecture 3. — Life and houses in the middle ages: Country houses, not castles, in northern Europe; mode of life; character of ornament; comparison with town houses and castles.

Lecture 4. — Mediæval town palaces, in Italy: Type; mode of life; character of ornament and decoration in fresco painting, wood-work, sculpture, etc.; merging of decoration and architecture into early Renaissance style; characteristics of this style, and the principles it embodies.

Lecture 5. — Palaces and villas in Italy in the sixteenth century: Highly developed social life; character, style and importance of decoration.

Lecture 6. — Castles, town and country houses in northern Europe in the sixteenth century: Type remains northern, while architecture and decoration are influenced by the Italian Renaissance.

Lecture 7. — Seventeenth and eighteenth century: The modern country house; type; arrangement; discussion of purposes of different rooms, and style of decoration and furniture suitable to them.

Lecture 8. — The modern town house and flat discussed from the same point of view.

Boston Normal School of Cookery.*

The training given at this school is exclusively for those intending to teach the "science and art of cookery," and affords a thorough and careful instruction on educational and technical lines. The course includes the science and technique of cookery, and such other sciences and normal methods as are important to a study of the subject. The physiological aspect is one of the fundamental considerations.

The aim of the school is to present the subject in a broad and attractive way; to interest and instruct by such methods as shall fit the pupils to fill the positions of teachers in manual training and domestic science schools, for which there is a growing demand.

The class is limited, thereby affording the pupils the advantage of constant personal attention on the part of the instructors, as well as the important one of individual manual and technical practice.

The time required is that of the school year, from October 1 to June 1, divided into two terms; the hours from nine to two P.M. each day, except Saturdays, with the usual school holidays.

Outline of School Schedule.

The instruction is given by means of lectures and recitations, as well as by continued practice in the kitchen laboratory. The "outline of chemical theory" is taught with laboratory experiments; also the principles of chemistry, as applied in the "chemistry of cookery."

First Course. — This includes a study of combustion and heat; composition and use of fuels; construction and use of gas and coal ranges; composition of the human body, and the use and adaptation of foods to supply its constituents, heat and energy; the "food principles," their chemical properties, and the application of moist and dry heat to the conversion of food materials into good feeding; the chemistry of cookery, as applied and demonstrated by the general use and preparation of food substances, in the making of simple dishes, illustrating the fundamental principles of cookery as well as the methods (of cookery); the various food substances, as milk, eggs, fish, the cereals, vegetables and fruits, are studied as to their composition and dietetic value, use in combinations and variations, and in the making of these simple dishes, with ways of utilizing food materials.

In connection with the work thus outlined, lectures are given on

* L. A. Nicholass, principal.

human physiology, by a physician ; on the anatomy and physiology of the digestive organs and processes of digestion ; marketing, with practical demonstration on the selection of meats.

Second Course. — This includes the preparation of class lessons and outlines of subjects to be presented ; practice and observation in the public-school kitchens ; demonstrations of lectures in cookery ; consideration of dietaries ; preparations of menus, with costs ; table setting and serving ; history of pedagogy ; lectures on psychology.

Third Course. — The making of more elaborate dishes, as fancy breads and pastry ; fancy desserts and cakes ; fish dishes with sauces ; ices ; roast game ; entrees ; preserves and jellies ; candies.

Cookery for the Sick. — This course, as outlined, affords especial instruction in the use and preparation of dishes for the very sick, as well as for the convalescents The pupils are thus enabled to make a specialty, if desirable, of training nurses connected with hospital training schools, in this department. The course is arranged as follows : —

1. Preparation and cooking of broths and acid drinks.
2. Cooking of starchy foods and gruels.
3. The making of nutritious liquid foods with and without stimulants.
4. Use and preparation of meat and other jellies.
5. The cooking of meats, eggs and other solids and combinations.
6. The arrangement and serving of dishes for the sick.

Instructions are also given in the purchase, use and care of household utensils ; the fitting and equipments of school kitchen laboratories, with costs. Visits are made to business firms, to afford knowledge of the selection and manufacture of goods and materials for practical and useful purposes.

The diploma of the school is given to such as satisfactorily complete the required course in the "science and art of cookery," with examinations, and after giving practical evidence of their ability to teach the same.

Municipal School of Useful and Domestic Arts, 20 Fondary Street.*

Object of the School.

The Municipal School of Useful and Domestic Arts is designed to give young girls who have finished their primary studies the

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* Founded May 2, 1881, by the city of Paris.

means of learning a lucrative business, at the same time training them in household cares, and thus preparing them to fulfil the duties which await them in the family. Young girls will also find in the school courses designed to fit for examination those who have not the certificate for primary studies, and to improve in their studies those who already have the certificate. Instruction is free. Pupils come to school at 8 A.M. and leave at 5.30 P.M., daily. Only day pupils are received. The apprenticeship lasts three years.

Professional courses: dressmakers, seamstresses, embroiderers, corset-makers, laundresses, flower-makers, milliners, tailoresses.

General courses (required of all the pupils): primary instruction, domestic economy, elements of book-keeping, drawing, gymnastics, cutting and making.

During the whole course pupils will be trained, in turn, in plain sewing and in kitchen and household work.

All pupils must bring their lunch or take it at the school lunch room, as no permission to leave the building can be granted during the day. Scholarships giving lunch and clothing may be granted to pupils deemed worthy.

At the end of the apprenticeship a certificate and a savings-bank book will be given those who pass all tests of the final examinations.

Entrance examinations will occur at the school Thursday, July 28, at 8.30 A.M., for the first list of applicants, and Thursday, September 29, at the same hour, for the second list.

Applications will be received at the school from June 15 to July 27 inclusive, and from September 19 to September 28 inclusive, from 9 A.M. till noon. Girls must be at least thirteen and not more than fifteen years of age. However, those holding primary certificates may be admitted at twelve years. They must present: (1) a certificate of vaccination; (2) their certificate of birth; (3) a certificate from the mayor that they are of French nationality, and reside in Paris or in the department of the Seine. Children living in suburban towns may be admitted to the professional schools of Paris if their rank in the examination warrant it, on condition that the towns to which they belong pay the sum of forty dollars for each child. These girls must apply in the first series.

Report presented in the Name of the Committee of Supervision and Improvement of the Girls' School of Useful and Domestic Arts, 20 Fondary Street, on the Appropriation of 1892 and on the Working of the School, by Mr. Bassinet, Municipal Councillor.

Gentlemen: — The Municipal School of Useful and Domestic Arts was established as an experiment in two rooms of the city school for girls, Violet Street, in May, 1881. It opened with seven pupils; in October, 1882, there were fifty; finally, when the school opened in October, 1883, they numbered eighty-five; and, as the rooms were not sufficient, the municipal council then voted the necessary funds for larger quarters. In April, 1884, the professional school was permanently established, with one hundred and eight pupils, in the building where it now is, 20 Fondary Street.

At first there were two rooms for sewing; to-day there are twelve, with two hundred and seventeen pupils (dressmakers, seamstresses, embroiderers, makers of artificial flowers, corset-makers, laundresses, milliners and tailoresses).

Regulations.

Pupils are admitted to the school daily, except on holidays, from 8 A.M. till 5.30 P.M. They may bring their lunch, which may be warmed at the school restaurant; or may there obtain, for the small sum of five cents, a soup, a plate of meat and vegetables.

Absence, without previous permission of the principal, must be excused by a note from parents or guardian, stating reasons. During the day, parents are notified by the principal of all absences. Unexcused absence is punished. It it occurs too often, the supervising committee, at the request of the principal, expels the pupil.

As pupils return home each evening, parents are not allowed to visit them during the day without especial reason, left to the discretion of the principal.

Monthly marks are entered on the pupils' note books, indicating their work and deportment. The principal receives parents daily, from 8.30 to 9, and gives more complete information than that entered in the books.

The results of the term examinations inform the parents of the progress made by the child in the instruction given.

Pupils' dress, in the establishment, is optional, but must be neat and decent; pupils must be provided with a black apron.

Pupils owe respect and obedience to all persons holding any position in the school. The committee and the management are anxious to accustom the children to those habits of politeness which are the mark of a good education.

No pupil is allowed to leave the building alone, without a permit from the principal, which must be handed to the doorkeeper.

The rewards in use are: good marks entered in the note books; the vacation trip given the pupils who have obtained the best marks; the

prizes given pupils of the first and second year; those of the third year also obtain savings-bank books.

The punishments are: loss of credits; entering a bad mark in the note book; reprimand of the supervising committee; public reproof; suspension; and expulsion, on the principal's report, with reasons, to the supervising committee.

Programme.

A. General courses taken by all the apprentices: —

1. Primary instruction, properly so called.
2. Elements of accounts.
3. Industrial and ornamental drawing.
4. Plain sewing.
5. Cutting and making.
6. Instruction in housekeeping; mending.
7. Gymnastics.
8. Domestic economy and practical instruction in kitchen and household duties.

B. Special courses of technical instruction: —

1. Sewing and making.
2. Making and trimming handkerchiefs, shirts, underclothing, etc.
3. Washing and ironing.
4. Embroidering goods for dresses (gowns) and furniture.
5. Making artificial flowers.
6. Corsets.
7. Waistcoats.
8. Millinery.

The faculty comprises: —

1. The principal, appointed by the minister of public instruction, with the advice and consent of the ministers of commerce, industry and the colonies, on nomination of the municipal council.

2. The assistant teachers and instructors in general subjects, who have hitherto been appointed by the prefect of the Seine, but who shall in future be appointed in the same manner as the principal.

3. The special instructors, appointed by the prefect of the Seine from a list of three candidates nominated by the supervising committee, after competitive examination.

Medical Service.

Doctor Bra, school physician, appointed by the prefect of the Seine, makes regular visits to the school, for which he receives sixty dollars per year.

A large number of the pupils who have left the school since 1883, even those who did not finish their apprenticeship, have experienced some gain from the trade which they have been taught; several have remained at home. It is not rare to find former pupils earning from 2 to 5 francs (40 cents to $1) a day as embroiderers. The earnings of the washerwomen vary from $0.30 to $0.60. Some are in business for themselves. The dressmakers, for whom it is more difficult to find places, on account of their number, earn from $0.30 to $0.70. The milliners and the corset

makers find places at from $0.60 to $0.80 a day for the latter, and $12 to $15 a month for the former, with meals. A few, among the beginners, have their board only. We can as yet give no results for the tailoresses, as the room has only been open two years. As for the flower makers, the trade is but little sought in our quarter. The room has always had from five to seven pupils, except last year, when we had nine. Under these conditions it has not been difficult to find places for these graduates. Only one is in business for herself, and the rest (one or two per year, at most) have found places at from $0.40 to $1 per day.

School of Womanly Handiwork, Rome, Italy.

This school, founded twenty years ago by one of the public-school teachers, is now supported mainly by the municipality, and is under the personal patronage of the queen and a commission of two gentlemen and twelve ladies, one of them an American. The curriculum includes sewing by hand and by machine on underclothing and shirts ; making undervests of silk and wool ; dressmaking ; mending of all fabrics ; lace making, for use in repairing laces ; hand embroidery in gold, silver and silk ; machine embroidery ; stocking weaving ; artificial flower making from natural models ; laundry work and cooking ; also drawing and geometry, as applied to design.

In the dressmaking classes the work is carefully graded from the simplest garments to costumes made for the queen and ladies of her court. The laundry department sends out every day scores of garments beautifully laundered ; each graduate from this room is fitted to open a laundry of her own. The cooking classes send to patrons daintily prepared breakfasts, luncheons and dinners, and also cook delicacies for invalids and prepare diets ordered by physicians. In the mending class room diagonally torn cashmere, frayed silk, costly laces and fans, worn table linen and fabrics covered with intricate designs are so perfectly mended that it is difficult to determine where. The drawing classes reproduce many designs from priceless bits of fabrics, vestments and parchments which are centuries old. In embroidery remarkable work is done on silk and satin with gold, silver, bronze and silk thread ; this is shown on such articles as superbly wrought church vestments, table covers, rich garments, etc.

The secrets of many ancient tints and colors have by long and patient experiments been discovered at this school. Every shade in an India shawl or any elaborate ancient fabric can be reproduced by these girls themselves in the dyeing room of the school. The old, exquisite dyes are bestowed on silk, wool and linen

threads, and these are carefully spooled, so that their supply of the subtlest tints is almost unlimited.

The North Bennet Street Industrial School.

This is a private enterprise, carried on in the interests of public education and social reform.

In the year 1885 an order was passed by the committee on manual training of the Boston school board, granting permission to pupils to accept the offer of Mrs. Quincy A. Shaw to receive manual training in the North Bennet Street Industrial School, "provided that parents of pupils should so request." Cooking, housekeeping and laundry work were offered to girls, printing, carpentry and shoemaking to boys. To these clay modelling and Swedish sloyd were afterwards added. Housekeeping was combined with lessons in cooking, while laundry work was found to be impracticable. From that date until the present time classes from public schools have been regularly received here, during school hours and under school discipline, for weekly lessons during the whole school year. Over one thousand such public-school pupils received manual training here during the school year of 1890. Between three and four hundred more were members of the summer classes of the vacation school.

The conditions of this undertaking have been such that, in addition to giving good training to this large number of boys and girls, it has been possible to do some valuable experimental work in various directions. Cooking and Swedish sloyd are conspicuous instances of successful experiment. This school has also served as a perpetual object lesson and laboratory for the public benefit, in which has been found not a little of its value. Students of the subject of manual training have been constantly invited to study and to criticise the work, and this invitation has been widely accepted. That by its means persons have been helped to reach satisfactory conclusions is seen in the fact that manual training movements have been started in various suburbs of Boston, and in many other parts of New England, whose first impulse was received at the North Bennet Street School.

Educational carpentry, both after the Russian and Swedish systems, modelling in clay, cooking, printing and work in leather are all carried on at present with full classes; but, while it has been found possible to employ educational methods in the last two courses, it is not thought that these should be urged upon the school curriculum. Sewing is an important part of the work of the

vacation school during July and August, and, together with dress-making, is also a feature of the evening work.

The name of this school is a misleading one, but is retained as an inheritance from earlier days, when the methods of the institution were more philanthropic than educational. Philanthropic and special work still have a place in this large undertaking, which reaches by its ministrations, by means of the work of the evening as well as the day, the summer as well as the winter, more than two thousand persons annually.

APPENDIX N.

VISITS OF MRS. HOPKINS TO VARIOUS MANUAL TRAINING SCHOOLS; WITH RULES AND REGULATIONS OF ADDISON STREET INDUSTRIAL SCHOOL, LIVERPOOL; AND PAPER ON DOMESTIC ECONOMY, ETC., BY MRS. ELLEN H. RICHARDS.

EQUIPMENT AND COST OF COOKERY SCHOOL.*

Housekeeping Equipment. — List of utensils needed: 1 long-handled bristle brush; 1 short-handled bristle brush; 1 large feather duster; 20 small feather dusters; 1 blacking brush; 1 polishing brush; 21 small scrubbing brushes; 2 small vegetable brushes; 1 vegetable basket; 12 yards dish towelling; 6 yards glass towelling; 18 yards of roller towelling; 10 yards coarse crash for dish cloths; 5 yards coarse crash for oven cloths; 5 yards cheese cloth; 3 yards dark cleaning flannel; 1 yard fine crash for cloths for wiping meat, fish and fruit; 10 yards gingham for aprons for housekeepers; 1 table cloth; 1 extension table; 1 small refrigerator or a box built out of window; box for wood and coal; book case, with drawers below; 20 earthenware soap dishes: 1 two-quart pitcher; 1 one-quart pitcher; 6 large plates; 6 small plates; 4 platters (1 large, 1 medium and 2 small); 6 cups and saucers; 3 one-pint round yellow baking dishes; 3 one-pint oval white baking dishes; 4 small nappies; 4 medium nappies; 1 dozen quart bowls; 2 dozen sauceplates; 1 small beanpot and cover; 6 glass tumblers; 1 small molasses jug; 1 small vinegar jug; 12 two-quart Mason jars; 12 one-quart Mason jars; 12 one-pint Mason jars; 1 hammer; 1 pair scissors; inkstand, pens, pencils, etc.; blackboard and eraser.

Cooking Equipment. — Running expenses, about one cent per pupil for each lesson. List of utensils needed: 20 hardwood meat boards; 20 rolling boards; 1 towel roller; 5 rolling pins; 5 wooden potato mashers; 1 bucket for flour; 1 twenty-five-pound bucket for sugar; 1 fifteen-pound bucket; 2 flat wooden spoons; 1 nest wooden boxes; 1 wood-fibre crumb-bucket, with cover; 1 arm

* Class of twenty pupils.

towel rack; 1 small towel horse; 10 agate (or granite) desk pans; 1 agate dish-pan; 5 one-quart agate saucepans and covers; 5 two-quart agate saucepans and covers; 1 agate hand basin; 1 six-quart agate stewpan and cover; 1 four-quart agate stewpan and cover; 20 tin measuring cups, three part; 20 tin measuring cups, four part; 20 tin plates; 20 round tin pans; 20 salt boxes; 20 pepper shakers; 5 small tin saucepans; 5 double boilers; 1 dish drainer; 1 wire soap dish; 1 soap shaker; 1 chain dish cloth; 1 two-quart tin dipper; 1 dust pan; 2 wire potato mashers; 1 nest spice boxes; 1 two-quart can; 1 quart measure; 4 small bread pans; 1 medium bread pan; 2 shallow cake pans (small); 2 deep pie plates; 2 shallow pie plates; 1 squash strainer; 1 large pudding pan; 2 bread graters; 1 meat pan; 1 meat rack; 2 iron muffin pans; 1 Scotch bowl; 1 double wire boiler; 1 double wire toaster; 20 case knives and forks; 20 vegetable knives; carving knife and steel; 20 table spoons; 40 teaspoons; 1 basting spoon; 1 skimmer; 1 griddle cake turner; 6 iron match boxes; 1 sink scraper; stove; nickel teakettle; 1 long-handled shovel; 1 poker; 1 lifter; 2 galvanized-iron coal hods; 5 French frying pans; 1 nutmeg grater; 2 doughnut cutters; 2 biscuit cutters; 2 cooky cutters; 4 small baking sheets; 1 flour scoop; 1 small scoop; 1 small grocer's funnel; 1 tin box for matches; 1 flour dredger; 2 gravy strainers; 1 coffee can; 1 tea canister; 1 tea strainer; 1 small tea-pot; 1 small coffee-pot; 1 wire spoon; 1 flour sifter; 2 extension strainers; 1 set skewers; 1 egg beater; 1 lemon squeezer.

Equipment and Cost of Kindergarten and Sewing School.

Kindergarten. — Tables, about sixteen dollars each, accommodating each eight children; chairs, fifty cents each; gifts, one set for each child. The running cost of a kindergarten of forty children is about thirty dollars the first year, afterwards about fifteen dollars.

Sewing School. — Needles, thimbles, scissors, thread, cloth. In Boston the total expense for about fourteen thousand girls in the grammar schools is two hundred dollars per year, or about one and a half cents per pupil.

Visits of Mrs. Hopkins to Schools in New York, Willimantic and Springfield.

In March, 1892, I visited the Training College for Teachers, Professor Adler's Workingmen's School and Mr. Hugh O'Neil's Grammar and Primary School, in New York City.

In the Training College I examined the course in wood carving for girls, chiefly reproductions of historic ornamentation, borders, etc., from Egyptian, Grecian, Latin and Moorish classic designs, also some wood carving from plant forms. I examined also the wood-work for primary and lower grammar grades, to be done by boys and girls in the class-room with adjustable desk tops and set tools. I saw the work done with the knife, saw, chisel and plane used by children from ten to fourteen years of age, the models being a modification of sloyd. Some fine card-board construction work and some flat wood carving I observed also.

In Professor Adler's school I especially investigated the sewing, embroidery, millinery and draughting systems for undergarments and dresses. The work done in this school is not essentially different from work of the same grade in Boston schools. The mechanical and geometrical drawing, as well as the clay modelling, were, however, particularly good.

At Mr. O'Neil's school object drawing and clay modelling from objects were prominent features, and, considering the age and antecedents of the pupils, they were suprisingly good. Paper cutting and paper reproduction of geometrical forms by exact measurement were also excellent. Manual training had become a method for all branches of study in this school; observation, experiment and tangible representation were required in every department of work and thought. The children were creative and independent, as well as practical and apt in the use of tools and their hands.

In Brooklyn, in the Pratt Institute, cookery was admirably conducted as applied science and by the actual performance of the art. Fine embroidery was also a noticeable element of the course. Modelling from casts for practice in art and sculpture, and drawing and design in color, were finely carried out. The art models were very complete and choice for all this work. The different laboratories were thoroughly equipped, and all the conditions for advanced work in artistic lines as well as in all the lines of science applied to industry were lavishly provided.

I talked with Dr. Hailmann and Dr. Klem, during my stay in Brooklyn, about the manual training of the kindergarten and primary courses. Dr. Hailmann advocated much freedom in the adaptation of Froebel's occupations to the genius and demands of our country and the times. He thought the kindergarten should be so conducted as to meet the natural tastes and aptness of the children and the rapid growth of mental activity and of new ideas of this country, as distinct from Germany. Not so precisely what Froebel laid down for the children of his own land and time as

what he might lay down for children now and here. Follow nature in the spirit in which Froebel followed it, keeping the principles of his philosophy in mind, and start out in new directions of industry and activity. Dr. Klem, on the contrary, wanted the child taught to work at his father's trade so as to be able to earn his living as soon as possible, and to begin even in the kindergarten and primary schools to make especially what would bring some money return, however small, at once, so that he could help his parents in his support. Dr. Hailmann emphasized the moral element in manual training, and proposed a plan of mutual helpfulness through the work of different grades of manual training, — the card-board boxes made by one class to be given to another class for holding specimens for natural science study; the objects made in the sloyd classes to be given to the cooking or gardening classes or to the clay-modelling classes for immediate use; the objects in clay to be used by the drawing classes; the articles prepared by the sewing classes to be turned to account for carpentry or cooking classes; the paper and color work of the kindergarten and primary school to be sent to various rooms for decorative purposes, and everything done for mutual and social good feeling, thus laying the foundation of social relations, and connecting every act with the expression of kindly feeling and utility. Dr. Hailmann also advocates the preservation of every effort of the child, however crude, because the child's feelings and self-respect will be injured by its destruction; he deplored the habit of regarding as rubbish what the children had put their thought, their effort, their imagination and their affection into; some way should be found to appropriate them to the pleasure if not the use of others.

I talked, also, with Miss Grace Dodge of New York, whose connection with education and with working girls' clubs is well known. She is one of the trustees of the Training College for Teachers, was very desirous that I should see the apparatus, models and work of that course, and offered me every facility for observation. She talked of the courses suited to girls, and urged most seriously that the educational motive should determine the subjects and methods, and not the industrial or utilitarian ends. She thought the people should not be taxed for opportunities to learn trades, but that the industrial schools should be supported by fees or by public charity; her great interest in the working girls had not changed but only confirmed this opinion, that the public schools should keep the educational aim uppermost in all their methods and departments of work; she went so far as to prefer that dressmaking and cooking be left out, as they were too much on the side of trade teaching. Her opinion, founded on

approved good sense and practical experience, as well as large opportunities of studying the industrial problem, gave great weight to her testimony.

I visited the New Britain Normal and Model School, in charge of Mr. Carroll, who seems to have set in operation a most truly progressive system of training, beginning with the kindergarten and reaching through the normal grade. The whole work is a beautiful example of free natural methods. The kindergarten is the living spring of method and outgrowth in all departments. Little ones of three years form some of its classes. They have a sand garden in the room. Every group of twelve or fifteen has a special teacher, under the guidance of the kindergarten principal. The children of four years work with color, putting on washes with the brush upon a drawn outline, painting from a real object, *e. g.*, leaves, flowers, a house, etc. Some of this color work was artistic in its breadth and harmony as well as its vivid realism. They painted what they saw in tint and depth as well as variety of color. Classes of five years were well started in literature. Pictures and stories of Longfellow were given them, some of his poems read, and they had a model of his house, a drawing of which they colored very nicely; they pricked and sewed the drum which his father got him when a boy, and the foot-stove he carried for his grandmother; they cut out, tinted and mounted a profile of Longfellow, which was to be the frontispiece of a Longfellow book they were to make, in which all the reproductions of incidents in his life or such writings as they had heard should be presented. Hiawatha was begun, and they had modelled a peace-pipe, and were going to sew outlines of a papoose, a wigwam, a squaw, etc.

The kindergarten children have sloyd in the shop, with the turning saw, the file and the plane, and many of the sloyd pieces they did were worthy of a grammar class. They enjoyed the work hugely. I saw a little girl perched upon the top of the bench on her knees, scouring off her semicircle for a bracket with an abandon of delight. The songs and games, the stick laying, block building and sewing were as usual, but very little pricking is allowed, on account of its danger for the eyes. The games were rather free and more spontaneous than is possible in many kindergartens, because the children were mostly from cultivated homes and knew how to play, and there were many more teachers than in an ordinary kindergarten. But the prettiest feature of all was the dancing; several dances with correct steps and form are carried on in the most spontaneous and graceful way by teachers and children with great freedom and life. It was a beautiful sight.

I visited the Willimantic Normal School; the kindergarten was carried on under the principal, with normal school pupils as assistants. Each class had from eight to twelve children in it. A class of about seven years were studying plant life. They had beans and peas under consideration. Each child was provided with a bean and a pea, also a soaked bean and pea, from which they could easily separate the skin; also a bean and pea which had been planted a few days in a little sand garden and had begun to sprout. They studied their specimens with close observation, and then they proceeded to separate the skin from the pea and bean, examined it carefully, and afterwards drew on a slip of paper a copy of the skin of the bean and pea, and of the bean and pea before being soaked; also of the bean and pea as they had germinated with the stem and root partly developed. After talking with the teacher about these different specimens, as to how they grew, and after examining and investigating the new growth of those which were partly germinated, the lesson was over for that day, but to be continued by thorough observation of the growth of the plants. I afterwards saw this class take a lesson in geometrical drawing; problems were given them which they immediately solved by pencil, dividers, rule and rubber. They worked out the problems with a great degree of interest. Little children four years old were taught to use the brush and a wash of color; and to copy from plants placed before them. Their work showed a great deal of feeling, and was very neatly done. The brush was very neatly handled, showing that the work was practicable for little children under proper direction. The older classes of the kindergarten formed the afternoon primary school classes in the hands of the kindergarten principal. They were also put into the shop and given tools for wood-work with the benches. The little children seven years of age produced very neat specimens of sloyd work, using the cutting saw, chisel and plane. The boys ten to twelve years of age made excellent models of the apparatus of physics, also some little toys, such as the pop-gun, water wheel and windmill. They had working drawings of every process in carpentry. The children were allowed great freedom in the shop. Nothing they made was destroyed. It was considered very important that they should have the advantage of making use, if they chose, of every piece of work they had made. In the Willimantic School the teachers of the normal school were constantly brought in contact with the pupils of every grade, so that they might understand their needs and conditions. Manual training was used as a method in connection with every method of study.

I visited the Springfield schools, and observed the method

formulated by Milton Bradley, which was carried on by the regular teachers, and the knife was the only tool used. The patterns were simple, but seemed to be rather difficult for the knife alone. I think work done with the knife in the Springfield schools could be much better done with the chisel and the cutting saw, and that nothing was gained in manual training by the use of the knife in that way. The knife cutting was done at the ordinary desk by the pupils of the third and fourth grades, grammar school.

Visits of Mrs. Hopkins to the Schools of Philadelphia, Washington and Baltimore.

In visiting some of the schools of Philadelphia I found kindergarten methods carried out in one school only; this was the Landreth School. Here I saw a remarkably well-organized school of several grades in a new and finely appointed building. Paper folding and cutting, clay modelling, sewing, illustrative drawing, object drawing and collections in elementary science were everywhere to be observed. Cases of specimens of school work in all these lines, as well as the clay, wood and metal work of the manual training school, lined the walls of the main corridor, and cabinets of specimens adorned the teachers' attractive room. In every school-room two housekeepers were detailed each week from the class, whose duty it was to distribute and clear away tools and material, wait upon visitors, and attend to the machinery of the room in all respects without special direction, thus relieving the teacher and the class from waste of time and energy, and at the same time training the members of the class in turn to look after the domestic appointments of the room, and carry a little independent responsibility; this plan had a very good effect on the conduct of the room and of individuals. Housekeepers for the school were detailed in the same way; these attended to all general notices and announcements, to the ringing of the bell for opening and closing the school, for recess and all general exercises, also to the setting of a table and serving a lunch for the teachers at noon in the teachers' room, as well as to putting all things in order after it. Everything moved easily and like clock-work, and the practical exercise of housekeeping was a capital opportunity in and application of domestic training. The work in manual training was excellently graded, although the drawing was rather the weak spot. Geographical modelling in sand was rapidly and accurately done; as a sample of that work, the United States was constructed physically before our eyes on a large table. The school seemed to be

an advanced and special effort toward the adoption of kindergarten methods in the various grades, and, like some of our Boston schools, awaiting the coming up of the slow majority. The paper work is about the same as in primary grades in Boston.

Later I visited the manual training school for boys, which is about equivalent to shops for boys in the North Bennet Street, Jamaica Plain and Roxbury manual training rooms, but carried on into metal work and electricity, as well as more advanced carpentry. The literary work in this school was as largely by laboratory methods as practicable. Maps, charts, in fact, historical illustration in every form, was a prominent feature. Everything in manual training was done from working drawings made by the pupil. Specimens of graphic representations of historical study from the class room showed facility in design and execution, and apprehension of the historical facts and spirit. The buildings and accommodations were contracted and meagre, the boys very much crowded, and no appearance of luxury, or even of thorough convenience, was noticed; yet all the boys were industrious, happy and successful.

In Washington I spent about two hours in examining collections of school work in the superintendent's office, such as were exhibited at the Conference on Manual Training, in Boston, from the schools of Washington. Every branch of manual training mentioned in the Boston Course of Study was represented, and was of excellent quality.

I visited many schools of all grades, and saw that manual training methods were thoroughly engrafted on the schools of Washington, or, rather, incorporated into them, for the work was in every grade, in logical sequence, thorough operation, mortised carefully both as to grade of school and kind of work, and completely inter-related with all the school work, making a homogeneous and philosophical as well as practical scheme of education for the public schools. The cookery rooms were, with the carpentry rooms, in every large school. The equipment was not quite as complete as that in Boston, but the methods appeared the same. The primary and grammar schools are without exception working out the scheme of manual training in advanced kindergarten lines, and the high school for girls and boys is a remarkable development of the same idea; the botanical, geological and biological, as well as mineral, physical and chemical laboratories are most inclusive and heterogeneous in their outlook, as well as harmonious in their purpose and method. Music and art, as well as some of the arts and industries now so commonly pursued by both young men and women for a livelihood, are also open to the pupils.

Washington has a complete system of manual training in its public schools, and I do not see, on a casual investigation, any reason to doubt its uniform success.

At Baltimore I saw the cookery instruction department for nurses in the Johns Hopkins Hospital. I was very much impressed with the thorough and finished appointments of the whole place, and the scientific and complete dietary course for the sick-room. The neat uniform of the nurses and cookery instructor was very suggestive. This course is one of closely applied science and more hygienic preparation of food than is followed in ordinary cookery schools.

Mrs. Hopkins' Account of Manual Training Exhibit, London, July, 1892.

Among the articles presented in this exhibit were sewing on card-board, canvas and coarse linen; macramé work; weaving in straw, worsted and twine for nets, fringes, rugs, baskets, etc.; knitting and crocheting for hoods, mittens, skirts; long, heavy stockings for deep-sea fishermen; undershirts and drawers for the ragged-schools; wash-cloths; towels and other useful articles; as well as many pretty things for gifts made by children five, six and seven years of age. Practice pieces, patches, darns, mends, samplers and button-holes, were all shown; also a few dresses, — some quite elaborate, — feather-stitching and flannel embroidery in the advanced classes; but the making of garments was not the most prominent feature of the sewing classes. Some sloyd work was exhibited, as well as constructive card-board work for use and beauty, geometric solids and other constructive work, — quite full and complete. The inlaid work of colored paper in symmetrical designs was very fine. Designs colored by wash and brush held a large place. The exhibit in color and drawing from the pupil teachers and from selected pupils of the advanced classes under specially trained teachers from South Kensington and other art schools was a noticeable feature of merit. The work in object drawing, with nature drawing, some of it by the brush alone, was excellent.

On the whole, the exhibit was not essentially different from those with which we are familiar in this country, and differed only in extent and variety from that of the Liverpool schools. A large preponderance of useful articles was to be seen in this exhibit.

The work in color is carried on under the supervision of an expert scientist and artist, who acts as one of the four assistants to the director of drawing in the schools. He attended me in exam-

ining this department. The work in drawing was of a very high order, and related to every department of study. It is not only a method of expression and representation, but of experimentation, being connected with laboratory work in the sciences as well as with mathematical and mechanical work.

On visiting London I obtained an interview with Mr. Diggle of the school board. He offered me every courtesy, and detailed a member of the board, Mr. McWilliams, to accompany me to representative classes and schools in manual training departments. We first called at the St. Berner Street Board School, on the spot where the opium joint described in "Edwin Drood" stood. We visited first the old school building, which was an old rice mill; the tall mill still stood there; the ground floor is now used as a storeroom. I saw a cart loading up with apparatus for drawing tables and large T-squares. We went up stairs and visited the cookery class of Jewish girls; the teacher was giving a demonstration lesson on a fruit pie; only a gas stove was in use. After this part of the lesson, which took one hour, the class was divided, one-half attending the demonstration lesson and the other half writing it for an hour, and the next hour vice versa; the lesson was three hours long, — each child has sixty lessons. The girls are eleven and twelve years old. The laundry room we next visited was large, with closets, boiler, tubs, ironing tables and stove with flat irons. A similar class to the cooking class was receiving a lesson from the black-board in washing cretonnes and colored cloths. After this I saw the girls washing at the tubs, one tub being fitted for washing colored articles, and the other for white silk scarfs or handkerchiefs which the girls had brought from home. I saw some of their laundered work also, cuffs and collars, — very good; the girls evidently enjoyed the work very much.

We then went to the new school-house near by, — Berner Street School. It was a fine large building, with well-lighted rooms, sliding partitions largely of glass, big halls and play-grounds for boys on the top of the building. We visited a sloyd class taught by the son of the head master; it showed very good work for the first year, — in operation only since the previous October. They used knife, plane, saw, etc., but the models were those in use in Mr. Larsson's class in Boston.

The pupils of the school are nearly all Jews, Russian or Polish, some German, who the master said were much the most intelligent. All have to be taught the English language, and much the same means are used as in the Eliot School, — in fact, when I described that way, the master said it was exactly his way, and he thought he had invented it. However, I saw the boys spelling small words

on the black-board in an old-fashioned way, without knowing what they meant or how to use them; then they learn to use a book and write words, and up in the higher grade to read fairly well. This was not in accordance with the method described.

All through the school were pictures, cabinets of science objects, collected by pupils and teachers with some help from a school fund. One teacher showed me her schedule of object lessons, — much like ours in the lower grades. Sewing is part of the girls' work. The boys come for extra time in sloyd. The master complained that as soon as the boys got up a little way many left to go to a Jewish school which gave them some advantages and was privately endowed, or else they went to America. Some of the teachers were Jewish; the teacher of the upper class was selected in order to conduct their religious exercises suitably. The cookery classes also have special provision for meeting the Jewish code with regard to food.

We went to the Highway School for girls, close to the scene of the worst White Chapel murders. It is a fine new building, about five years old. The care-taker lives in a house on the premises, and opens the gate to visitors; he had a beautiful show of potted plants in bloom, with pretty shells near the opening of the yard. All the girls were out at play, the mistresses with them.

I visited a manual training exhibit of the London board schools, and there met by appointment Inspector George Ricks, who waited upon me and explained in detail every part of the work, beginning with kindergarten occupations and proceeding through every grade of school and every department of manual training.

Visits of Mrs. Hopkins to the Schools of Paris.

I called at the office of the Minister of Instruction, and, presenting my letters signed by Governor Russell and U. S. Commissioner W. T. Harris, obtained a "permit" to visit the schools in the department of the Seine, for the purpose of investigating the manual training courses.

I went to the Sophie Germain Superior School for girls, and saw embroidery, millinery, flower-making, drawing, design in water color and dressmaking, tailoring and corset-making, all carried on in one building, and more extensively than with us. The dresses were fitted to lay figures, cut, basted, sewed, pressed, trimmed, etc.; fashion and artistic decoration were studied. In the art department costumes of various ages and countries were studied, and represented by drawing and color.

I visited the professional manual training schools of Poitou and Fondary, of the last of which I enclose programmes. I saw kindergarten work like our own, a few varieties being added, more in the direction of art than industry. The sewing consisted mainly of the elements of common sewing, on small pieces or samplers.

I saw laundry work and cookery, the former being thoroughly attended to, the latter somewhat meagre.

The history of art and study of costumes of all nations and ages was a part of the course in art instruction.

The kindergarten course seemed in the main what is familiar to us. The weaving was more with worsteds than paper, and ornamented by embroidery, with marked attention to color and beauty of design. Laundry work as well as cookery was carried on by girls of about twelve years of age.

Report of Mrs. Hopkins on Liverpool Manual Training Schools.

On reaching Liverpool I called upon Mr. E. W. B. M. Hance, clerk of the school board, and presented my letters from Governor Russell and from U. S. Commissioner Harris.

I first visited the Addison Street Day Industrial School, under the direction of Miss Tarry, a certified mistress of the board. This is a mixed school, for children of five years and upwards who shall be committed by a magistrate as neglected, or recommended by the school board. The school is open from 8 A.M. to 6 P.M., for compulsory attendance, from 6 to 8 A.M., for voluntary attendance, and on Sundays for voluntary attendance from 9 to 5.30. Secular instruction is given four hours per day, except Saturday, when it is three hours. The apparatus for teaching seemed as well provided as in the regular elementary schools. The maps and pictures, shops and tools and all the school-rooms were well equipped. The baths, lavatories, swimming tanks, barbers' rooms and disinfecting rooms were amply supplied according to the best sanitary regulations. Each child washes face, hands, arms, chest, legs and feet, with his own basin, cloth and towel, every day before 9 A.M., under supervision. Each child is served with three good meals per day. Religious service is held each day from 9 to 9.30 and from 5.40 to 6 P.M., denominational preferences being respected. The industrial training occupies half the day, and consists of mat making (rope), simple joining, wood chopping, netting, sack making, paper-bag making, laundry work, plain sewing, knitting and darning, dish washing, scrubbing, etc.

Only the superintendent may inflict or order punishment.

Admission is either voluntary on the part of the parents, or with a recommendation by the school board for children too poor to attend regular schools (ill-fed, ill-clothed and ill-cared for), or by license from a certified industrial school.

I also visited two certified industrial schools, one for boys and one for girls, at Northumberland Terrace, both established within ten years by Dean Porson. These schools take children committed by a magistrate for slight offences, or found in bad company, or cruelly treated and of vicious parentage, from brothels and haunts of crime; and they are taken care of night and day, the school clothing and feeding, instructing and training them in useful occupations. The children are taught to do all the work of the house, make their own clothes, boots and articles for sale, and to do plain carpentry. They are not allowed to leave the school except in charge of teachers or officers. When they are old enough they are discharged, or put to trades or other work to learn an honest living. They are sent away by the emigration act whenever an opportunity is offered which can be approved by the managers. The average cost of the school is sixty dollars a head, per year. The girls' school is in charge of a mistress, and the boys' of a master. The appointments for bathing are about the same as in the day industrial schools.

I saw boys at work in the laundry, kitchen, dining rooms, printing room, carpentry shop, sewing their own clothes, making their own and the girls' boots, making mats, bags, bundling sticks which they had sawed and split, scouring, playing games and studying. They looked healthy, happy, and in no way different from children of better circumstances, except in their uniform. The superintendent said they were not bad lads; he thought them as much inclined to do right as any other lads, but in their own homes it was impossible. District visitors and school visitors, acting somewhat like truant officers and somewhat as missionaries, keep the school supplied with pupils.

At the girls' school I saw them all at dinner. They rose as we entered the room. They looked remarkably healthy and quite content. I saw the clothes and sewing of the girls, and saw their dormitories (as also the boys'). Each child had a bed, about twenty-five beds in a room, well aired and lighted; a superintendent's room adjoining each dormitory, and a glass window between. The girls had blue flannel gowns and heavy linen aprons, a Sunday dress and hat as well as a common one. They make all their own clothes.

The wood-working shops were furnished with tools and benches like those in Boston, and carpentry exercises were taught. I did

not see anything like sloyd. The sanitary arrangements were most noticeable. Constant bathing and perfect regulations for cleanliness both of person and surroundings are secured. Swimming tanks are in daily use in the boys' school.

I visited two of the elementary schools of Liverpool, in company with Mr. Hance and Mr. Hewett, who is director of the science work of Liverpool board schools. The science work in the elementary schools is in charge of Director Hewitt (author of various treatises on elementary object lessons and science, and recently of a book on manual training) and of four assistants who are under his constant training, and who go into the schools and give lessons to the classes with the help and observation of the regular teacher, who also has to carry on the lesson at other times as he has shown her how and provided the materials or apparatus. The lessons to which I listened by two of the assistant directors were on physical phenomena, to which I think most attention is given in the science course. I saw no evidence of observation in plant and animal life, except in some potted plants in the school-rooms or passages, and in the kindergarten occupations, where some representations of plant forms were used from which to teach the names of different parts of the flowers. The science work is continued for boys of the higher standards in a chemical laboratory, as an incentive for boys to remain at school or to come in from outside; and evening classes of the same sort are provided for those who have left school. I understood, however, that the assistants had a peripatetic museum which was falling into disuse; the apparatus for physical experiments was very simple, and easily obtained in almost any school.

The infant classes were to a large extent taught by kindergarten methods; all the kindergarten material was conspicuous, and the children were engaged in the occupations. The tables were arranged like the ordinary school desks, but with the seats made to drop to order, so as to give standing-room; the tops of the desks were lined in squares, and the slates also for drawing designs in straight lines. Drawing of this kind was going on, as well as tablet laying, bead stringing, block building, crayon coloring of outlined forms, paper mat weaving, worsted weaving on pins in various forms of life, paper cutting and folding, drawing of geometric forms, cutting of the same in paper and card-board, leading up to flat wood-cutting in these forms, paper construction of forms of life, sewing on card-board, canvas, heavy linen and common cloth, knitting and embroidery, samplers and ornamental work, clothing, etc., as in our schools. All this work was admirably graded and connected, so that it was hard to say where the

kindergarten ended. It all combined to lead up to the shop work and science work, to geography and higher studies. They do not speak of "kindergartens," but only of "infant classes," and the numbers and reading are all taught by these methods. They do not seem to have the "games" as a part of the course. They call the shop work and paper and card-board work "applied drawing;" it all seems to lead to trades rather than art. They were all set to work with the manual training instruction for my benefit, and it was linked together so completely that I could hardly find the joining places.

One school of the two I visited was in charge of a Scotchman as head master; he wore a cap and gown, and seemed to be a very strong man in all respects, though a young man. They had a large swimming tank in this building, which the boys use daily. They are trying to get the girls to use one, which they are loth to do, although some of the pupil assistants do so.

The staircases are iron, and outside the building. The plan of the building is quite worth a study; sliding partitions of plate glass between all the rooms, so that the master can overlook many rooms at once, or the rooms be thrown together. The floors slope by steps to the teacher's desk. The windows are very large, of plate glass, high, and reaching to the extreme ends of the room and either behind or at the left of the class; large sky-lights distribute the light so well that there are no dark corners, and the plate-glass partitions aid in carrying the light all over the building, and accustoming the eye to distant sight as well as near. All the arrangements for lighting were directed by distinguished oculists. I saw very few pupils or teachers wearing glasses.

The teachers giving object lessons in science or dictation lessons in training were doing it very well indeed, and seemed intelligent and refined. The pupil teachers, quite young girls, were helping in the kindergarten occupations and paper cutting and folding, also in the lessons in spelling, reading, reciting verse in concert, etc. They acted in a natural, unconscious way, moving about among the aisles and affording substantial assistance. Mr. Hewitt said they grew up into teachers very naturally, getting accustomed to the children and sympathizing with them, learning insensibly how to appeal to them and guide them.

The playgrounds were ample. The pictures, charts and maps were such as we see in our kindergartens and other grades. The Scotch head master had cabinets of manufacturers' material in cotton, wool and silk, also some other things to illustrate geographical products, but no more than some Boston schools have.

There is used in these elementary schools a method of "cross

classification," so that a child may have one study with one grade and another with another grade, according as he shall have passed certain examinations which he has chosen by a liberty of selection which retards or advances him in certain subjects.

Drawing is taught to both boys and girls in the mixed schools, and is compulsory.

I visited one of several manual training centres or shops for wood-work, which is also called "applied drawing." The series of plates or models was very nearly like that in the North Bennet Street or the Jamaica Plain School; exercises for practice and mastery and objects for use was the educational motive. Some sloyd models are introduced towards the end of the course, for training in forming a judgment by sight and touch rather than by measurement, as in most of the course. Mastery of the tools and of the exercises is the object, and creates an interest which assures a boy's voluntary continuance in the shop and petitions to get extra time. Every boy in the board schools receives the instruction from ten to twelve years of age, for two or three hours a week for two years. Some voluntary schools send classes on payments of fees. The series of lessons brings in models of physical apparatus at the close. The boys are generally from the sixth standard. The head master of this centre is a young man, Mr. Pierson, who was a certificated teacher, and then studied manual training. He is quite opposed to sloyd.

The University College trains teachers for the manual instruction. I visited this institution, saw the wood-working shop with exercises in mechanical construction, mortises, joints, bevels, use of tools, working drawings, which are used in every exercise in the manual training throughout the school course; the engines, testing apparatus, electrical apparatus and museums of various patents started. It is a new institution, and will turn out thoroughly trained manual training teachers from the graduates of the training colleges, for the elementary schools. This completes the manual training course for the schools of Liverpool.

The cookery training school was closed, but Mr. Hance took me to the training class at the Convent of Notre Dame, — the best one, he said, in Liverpool. The Sister Superior showed me the tables, gas stoves and all the furnishings, — marble-topped tables, porcelain jars, tiled floor and glazed tiled walls, — very nice and clean. I saw no class. The Sisters were very courteous and hospitable, giving me a nice lunch. They showed me the sewing, which was fine, some of the embroidery beautiful. The knitting was conspicuous. There seemed to be no coldness between the Catholic and Protestant schools. The Sister Superior was a noble

woman, with very sweet manners, and consulted with Mr. Hance on many points of mutual interest. I told her about the Boston cookery schools, and how much had been done by Mr. Murphy; she seemed delighted with the idea of the horse-shoe tables and a gas stove for each pupil.

Mr. Hance conducted me to two of the entrance examinations of candidates for the Training College. It is an examination of nearly a week; I was furnished with copies of completed papers; it is conducted by government inspectors, and is much more difficult than our entrance examinations for the normal school; it presupposed some knowledge of the science of education. Only about forty out of several hundred were to be admitted to the Liverpool College, which is the best; the age of the candidates was from eighteen to twenty-one.

There are nineteen cookery centres, three teachers, eight hundred and eighty-four girls in classes this year, four standards six and seven.

Cricket and foot-ball clubs have been introduced, and matches arranged by the masters in the principal schools for boys.

The cookery centres of the Liverpool board schools are in an ordinary class room, adapted to the purposes of cookery by the use of movable desk tops and hinged seats let down, and a cabinet for storing utensils and materials; gas stoves only are in use, and the whole equipment is very inexpensive.

The tools used for wood-work are the common carpenters' tools, and not the knife.

The manual training centres or shops for wood-work were established in very inexpensive quarters, one large room with mere frame of building and patent iron roof; they were set up in haste as a temporary and cheap provision for what was regarded as an experiment, but, the buildings proving all that is needed and as good for the purpose as any, it is proposed to make them permanent. The University College also has expended a comparatively slight amount on its quarters, but endowed its chairs very generously.

RULES AND REGULATIONS FOR THE MANAGEMENT OF THE ADDISON STREET CERTIFIED DAY INDUSTRIAL SCHOOL, LIVERPOOL.

1. The school shall be a day industrial school, within the meaning of section 16 of the elementary education act, 1876, for the reception and detention of children committed by a Liverpool magistrate's warrant, under sections 12 and 16 of that act, and for the reception, under the provisions of sub-section 4 of the last-mentioned section, of children under attendance orders, or without an order of a court.

2. The school being provided by the school board, shall, under the

supervision of that body, be managed by a committee of the board (or by such body of managers as the board may from time to time appoint under the provisions of section 15 of the elementary education act 1870), hereinafter called the "managers."

3. The school shall be open for the reception of children of all denominations.

4. No child shall be received into the school under five years of age.

5. The school shall be open for the reception of children of either sex, and shall be conducted as a mixed school.

6. No child shall be received into the school who is incapable, by mental or physical infirmity, of being benefited by the instruction and discipline of the school, or who is suffering from any loathsome or infectious disease.

7. The number of children received into the school at any one time shall not exceed two hundred and fifty, exclusive of infants between five and seven years of age. The school board may, at any future time, with the concurrence of the inspector of day industrial schools, authorize the admission of some larger number, provided that it shall in no case exceed such a number as will allow in the school-room and day rooms ten square and one hundred cubic feet for each child present therein.

8. The staff of the school shall consist of the following officers, viz.: —

(1) A certificated mistress as superintendent;

(2) One assistant mistress; or such further number of assistant mistresses as the managers may, with the consent of the school board, from time to time consider necessary for the due instruction of the number of children in the school;

(3) A male caretaker, who shall be required to superintend the industrial occupations of the boys;

(4) A woman to act as cook; and

(5) Such further assistants (if any) as the managers may, from time to time, with the consent of the school board, prescribe.

9. The superintendent shall have sole charge of the school, and shall be responsible for the good management thereof, and for the due execution of all regulations relating thereto; for this purpose she shall have control of all the other officers. She shall also be responsible for the quantities and qualities of all supplies received for the school, and for the proper application thereof.

10. The appointment and discharge of officers shall — subject to the confirmation of the school board, and, in the case of the appointment of the superintendent, to the approval of the inspector of day industrial schools — rest solely with the managers; but the superintendent may suspend any officer for misconduct until she can report the facts to the managers.

11. On week days the school hours shall be from 8 A.M. to 6 P.M.; but the school shall be opened at 6 A.M., to receive children who may come, or be brought, at any time between that hour and 8 A.M.

12. The caretaker shall be in attendance at 5.45 A.M., and shall have the school ready for the reception of children by 6 o'clock. All children

arriving at the school before 8 o'clock shall until that hour be under his control, and he shall be responsible for their good conduct.

13. The teachers shall be in attendance at the school at 7.45 A.M., and, except when in charge of children taken out in pursuance of Rule 20, shall not leave the school during school hours without the special permission of one of the managers, or, in urgent cases, of the superintendent.

13*a*. The superintendent shall have power to grant temporary leave of absence to any scholar under either of the following circumstances, viz.: (*a*) the serious bodily ailment of the child; (*b*) the existence of some infectious disease at the child's home; (*c*) temporary absence of the child from home; (*d*) the sickness of some member of the family upon whom the child is required to attend; (*e*) keeping house in the temporary absence of the mother on exceptional and urgent occasions; provided that in every case the particulars of the leave granted, and the reasons for it, be entered in the journal, and that the leave be not continued beyond one fortnight without the special permission of the managers.

13*b*. The superintendent will be held responsible for the regular and punctual attendance of the scholars and teachers. Whenever a child is absent without leave, the superintendent shall inform the parent thereof, shall inquire by personal visitation or otherwise as to the cause of such absence, and shall make such record thereof as the school board or the managers may require. When the reasons for absence are not satisfactory to the superintendent, she shall immediately report the cases to the school board.

14. Every child sent to the school under an order of detention, and every child sent under an attendance order, or under a license from a certified industrial school, unless it is otherwise provided in such attendance order or license, shall attend the school during the whole of the school hours on every week day on which the school is open.

15. No child shall be allowed to leave the school during school hours without permission from the superintendent.

16. On Sundays the school shall be open between the hours of 9 and 5.30, for the reception of such of the children as may attend of their own free will.

17. Religious instruction shall be governed by the following rules: —

(1) Religious instruction and observances shall take place each day from 9 to 9.30 A.M., and from 5.40 to 6 P.M.

(2) The ordinary religious instruction and observances shall consist of prayers and hymns and reading from the Bible, with such explanations and instructions therefrom in the principles of religion and morality as are suited to the capacity of children; and in the selection of such prayers and hymns, and in explanations and instruction from the Bible, no attempt shall be made to attach children to, or to detach them from, any particular denomination.

(3) No child shall attend the religious instruction or observances, or shall be taught the catechism or tenets of any religion, to which his parents or guardians object, or other than that to which he is stated in the order of detention or attendance order to belong.

(4) With regard to children who are specified in the order of detention or attendance order as belonging to any particular religious persuasion, the managers shall, so far as practicable, make arrangements that such children shall, during the times set apart for religious instruction, attend religious instruction or observances conducted voluntarily by ministers of such persuasions, or by such responsible teachers of the school or other persons as are delegated by such ministers with the approval of the board.

(5) While any religious instruction or observance is going on, none of the scholars or teachers shall be employed in any other manner in the same room.

(6) Facilities shall be provided for special religious instruction being given at stated times on Sunday, by volunteers, to such of the children of their respective churches as of their own free will may attend such instruction.

18. The secular instruction shall consist of reading, spelling, writing, dictation, arithmetic, vocal music and drill; and, as far as practicable, of the elements of grammar, geography and English history. It shall be given on Saturday for three, and on each other week day for four, hours.

19. The industrial training shall consist: —

For the boys: Of such industrial occupations, including mat making, simple joinery, wood chopping, sack making, netting, paper bag making, etc., as the board or the managers may from time to time consider practicable and desirable.

For the girls: Of plain sewing, cleaning and other domestic work.

20. The children shall be allowed two hours daily for recreation and exercise, and may be taken out for exercise beyond the boundaries of the school.

21. On week days all the children, and on Sundays such of them as may voluntarily attend, shall be supplied with three meals a day, of plain, wholesome food, according to a dietary to be approved by the inspector of day industrial schools.

22. The hours for religious and secular instruction, industrial work, recreation, meals, etc., shall be regulated by a time table, to be approved by the inspector of day industrial schools, and to be hung up in a conspicuous position in the school-room.

23. The superintendent shall alone have the power of punishing or ordering the punishment of children in the school, and shall be directly responsible for all punishments inflicted. These shall be of the following descriptions only: —

(*a*) Forfeiture of rewards and privileges, including recreation.

(*b*) Reduction in quantity or quality of food, — but no child shall be deprived of two meals in succession.

(*c*) Confinement in a separate, but not dark, room during the school hours.

(*d*) In the case of boys, moderate personal correction by whipping with a common school rod or cane, and not to exceed at any one time five strokes in the case of a boy under nine years of age, or nine in the

case of a boy above that age.* No punishment for any particular offence to extend beyond the day on which it is inflicted.

All punishments, with the fault committed, shall be recorded in a book kept for the purpose, to be laid before the managers at their meetings, and to be open to the inspector for examination.

24. The superintendent shall keep a journal, — to be laid before the managers at their meetings, — in which she shall record all occurrences of importance; and shall also keep or cause to be kept the following books and records, viz.: —

(*a*) A register of admissions, containing a record of the date of admission, name, age, residence and religious denomination of each child received into the school, and whether it was admitted under a voluntary arrangement, a license from a certified industrial school, an attendance order or an order of detention, in the last case also specifying whether the original proceedings were taken under sub-section 1 or under sub-section 2 of section 11 of the elementary education act (1876); also such particulars concerning its parentage, previous education and circumstances as may be found requisite.

(*b*) Registers of daily attendance, distinguishing therein the children according as they are received under voluntary arrangements, attendance orders or orders of detention, and in the last case whether the original proceedings were taken under sub-section 1 or under sub-section 2 of section 11 of the elementary education act (1876).

(*c*) A punishment book, in which all punishments and privations shall be recorded, as required by Rule 23.

(*d*) A stock and store book, containing particulars of all materials and provisions ordered and received for the school, and the manner in which they have respectively been consumed; also of all orders for work executed by the school.

(*e*) A license register, containing particulars of the name, address and school attendance of each child placed out on license, together with the dates of the license, its renewal, and, where necessary, its revocation.

25. The school shall at all times be open to the inspector of day industrial schools. Members and authorized officers of the board may visit and inspect the school and examine the books at any convenient time. Parents of children in the school may, if necessary, communicate personally with the superintendent on Monday morning before ten o'clock. With these exceptions, no visitor shall be allowed to enter the school during school hours without the written authority of the clerk to the board, of one of the managers, of a member of the board, or, in urgent cases, of the superintendent. (This rule does not apply to tradespeople or customers coming to the school on business.)

26. The superintendent shall regularly and punctually forward to the inspector of day industrial schools the following notices and returns, viz.: —

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* The superintendent shall not be at liberty to punish any child by both corporal punishment and confinement in a separate room at the same time, or for the same offence.

(*a*) Notice on a form to be approved by the inspector immediately after the fact of the admission of each child, with information as to whether such admission is under an order of detention, an attendance order or a voluntary arrangement, and as to the period for which the child is received.

(*b*) Notice on a form to be approved by the inspector at the end of each month of any child having died, left the district, been transferred to another day industrial school, committed to an ordinary industrial school, placed out on license or allowed to be absent on leave.

(*c*) The registers of attendances duly vouched by herself and the managers at the end of each quarter, and at such other times as the inspector may require; also at the end of each quarter an account for the maintenance of the scholars in the school, distinguishing committed from voluntary cases, and specifying against each child's name the number of attendances it made during the quarter.

(*d*) In the month of January in each year a full statement, vouched by the managers, of the receipts and expenditure of the school for the year ending on the 31st of December immediately preceding, and showing all outstanding debts and liabilities.

(*e*) Such other returns and accounts as the inspector may from time to time require.

27 All books and journals of the school shall be open to the inspector for examination, and if he think it necessary he may examine any teacher employed in the instruction of the children.

28. No officer of the school shall receive any gratuities from the children or their parents. or from tradespeople, customers or any other persons, on pain of immediate dismissal.

29. No officer shall become security for any person, or engage in any loan transaction with any other officer of the board.

30. The officers shall maintain the discipline and order of the school, and carefully attend to the instruction and training of the children in conformity with these rules and with the provisions of the order in council of the twentieth day of March, 1877. The children shall comply with these rules and obey the officers of the school; and any wilful neglect or refusal to so comply or obey shall, on the part of any child sent to the school under an order of detention, be deemed to be an offence against the aforesaid order in council within the meaning of section 28 thereof.

31. These rules and regulations shall not be added to, repealed or altered in whole or in part except with the consent of the secretary of state, and at a meeting of the school board convened by a notice stating such business, and sent in accordance with the regulations for the time being in force for the transaction and management of the business of the board; but the school board, or, with their authority, the managers, may from time to time lay down special rules for regulating any matter not provided for in these rules, provided that such special rules shall not be in any way inconsistent with these rules, and shall be recorded in a book to be submitted to the inspector for approval on the occasion of his annual or other visits.

W. Inglis,

H.M. Inspector of Reformatory and Industrial Schools.

August 18, 1891.

Certified Industrial Schools (One for Boys and One for Girls).

Under the provisions of the elementary education act (1876), the duty is thrown upon the school board of putting into force the provisions of the industrial schools act (1866) and its amending acts. In addition to the services which can be rendered in this respect by their ordinary visiting staff, the board have, in conjunction with the Society for the Repression of Immorality, appointed two officers whose whole time is almost exclusively devoted to this work; while a third officer has been set apart for the investigation of the cases of all children brought by other agencies before the magistrates, under the terms of the industrial schools acts, — for a large number of cases is brought before the magistrates by the police, or by the officers of the Society for the Prevention of Cruelty to Children, and a considerable number, principally orphans, through the actions of private individuals.

On the 29th of September, 1888, there were in certified industrial schools 671 Liverpool children, viz., 429 boys and 242 girls. Through the combined action of the agencies before mentioned, and of the board's own officers, 769 children, viz., 562 boys and 207 girls, have been brought before the magistrates during the past three years, under the provisions of the industrial schools acts; and 375, viz., 220 boys and 155 girls, committed. Of this number, 141 were committed for frequenting the company of prostitutes, 69 for begging, 67 for stealing and 27 for vagrancy, while 71 (mostly orphans) were committed as "destitute." In addition to these children, 167, viz., 103 boys and 64 girls, were, during the same period, committed to industrial schools under the elementary education act of 1876.

Since the 29th of September, 1888, 278 boys and 149 girls have been discharged, and of this number 105 boys and 54 girls were licensed before the completion of their terms of detention. On the 29th of September, 1891, there were 786 Liverpool children, viz., 474 boys and 312 girls, in residence at these schools.

Industrial Schools Act, 1891. — Emigration.

Towards the close of last session a short but very important act was passed by Parliament, empowering the managers of industrial schools, with the consent of the children themselves and of the secretary of state, to dispose, by way of emigration, of children committed to those schools; towards the cost of which method of disposition school boards are, under the general powers conferred on them by section 27 of the elementary education act (1870), enabled to make contribution. With regard to the provisions of the new act, — which are in accordance with representations made, on more than one occasion, by the present board and by their predecessors in office, — the board have been in communication with the managers of the various industrial schools to which Liverpool children have been committed, but as yet no definite scheme for exercising the new powers has been prepared.

Work of Compulsion.

The visiting staff employed by the board at the present time consists of thirty-five male and twenty-one female permanent, and eleven male and one female temporary, visitors, acting under the direction of a superintendent, assisted by four inspectors. The permanent staff shows an increase of one male visitor upon the corresponding numbers employed at the close of the last board.

This staff is divided into two main parts: district visitors, of whom there are sixteen, and school visitors, of whom there are forty-six, the remaining six visitors being detailed for special work, — two in connection with the enforcement of the industrial schools acts, two with prosecutions under the education acts, one with the payment of school fees and one acting as assistant inspector.

The duty of the district visitors is to secure that all children of school age are enrolled at some school, and for this purpose: —

(*a*) To keep, as far as possible, a correct register of all the families in their respective districts;

(*b*) To visit, and, where necessary, to take proceedings in respect of children found to be not attending school; and

(*c*) To keep a record of children approaching five years of age, and to see that they go to school on attaining that age.

The register is kept up by means of a house-to-house visitation, which is conducted continuously throughout the year, and a complete round of which is made in about three months.

The duty of the school visitors is: —

(*a*) To secure the regular attendance of children whose names are on the rolls of schools;

(*b*) To trace, as far as possible, all children who leave the schools under their charge; and

(*c*) To notify to the district visitors all changes of residence coming under their notice.

Until August, 1889, the uniform practice was for the school visitors to be supplied with particulars with regard to the attendance of children once each fortnight, with a view to their visiting those who were irregular; and this practice still obtains in respect to the great majority of the schools of the town. In that month, however, ten temporary visitors, since increased to twelve, were appointed, to enable the experiment to be tried of obtaining the information and visiting the irregular children weekly, in connection with some thirty-six schools situated in localities in which the attendance was least satisfactory. The experiment was originally made for one year, with the result that in the schools selected the average attendance rose from a little over seventy-six per cent. to very nearly seventy-eight per cent. It was accordingly decided to continue the experiment, first, for a further six months, and subsequently for an additional period of twelve months, not yet expired.

In the discharge of the important and responsible duties devolving upon them in connection with the exercise of their compulsory powers, the board continue to receive most valuable assistance from a consider-

able number of ladies and gentlemen not members of the board, who have brought to the discharge of the duties entrusted to them an amount of tact, patience and devotion for which the board cannot express too highly their appreciation.

Domestic Economy as a Factor in Public Education.*

The public school of the American Commonwealth is a somewhat unique development in the educational institutions of the human race. Founded for all the children of the community, supported by the public funds in order to secure a constant succession of good citizens, that the State might be sure of being sustained, the school taught those subjects which were thought to best prepare for citizenship, the schoolmaster was to supplement, not supplant, home training. With this common aim, the children of those who ploughed in the fields were sent to sit at the same desk as the children of those who were the intellectual leaders of the community. The equality of mind thus recognized was typical of the spirit of the early Commonwealth. At a time when every man could load a gun, build a log house or a palisade, and every woman could spin and weave the cloth from which she fashioned the garments of her family, there was little need of manual training or domestic economy. It was the highest ambition to have the children furnished with the intellectual weapons which would enable them to take, in due time, a leading place in the community. Thus the public school was a factor, next to the "meeting," in the elevation of the people. Grown men and women used the few weeks of winter, when work was less pressing, for an intellectual advancement which was always recognized as fitting them for public duties, giving to them better language for the town meetings, more skill in debate, a reputation for quickness at figures. This was the condition of affairs only forty years ago, in the home of the public school, the Commonwealth of Massachusetts. But the first act of the general court in 1642 not only enjoined upon the municipal authorities the duty of seeing that every child was educated so as to read and write, but also that "all parents and masters do bring up their children and apprentices in some honest, lawful calling, labor or employment, either in husbandry or some other trade profitable for themselves and the Commonwealth." As Horace Mann so well stated the bearing of this early law: "Thus were recognized and embodied in a public statute the highest

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* By Mrs. Ellen H. Richards, Instructor in Sanitary Chemistry, Massachusetts Institute of Technology.

principles of political economy and of social well-being, — the universal education of children and the prevention of drones or non-producers among men."

The aim of education is now what it was then, to make good citizens, and those subjects which will best conduce to this end should be taught in the public school.

Times change and methods must change with circumstances. People no longer travel by stage coach; why should children be taught in the school just what their stage-coach-travelling grandfathers were taught? The citizens of the future are now in the schools. They are in just that stage of development in which they can most readily imbibe higher ideals of life and be influenced to better ways of living: shall the best thought of the time be withheld from them, for fear that they shall know more than their fathers or that they shall become too revolutionary in their homes?

In no branch of knowledge has there been greater advance in the last fifty years than in that of public health. In no department of science can so much be accomplished for the general good with so little expenditure as in teaching the elements of sanitary science.

It is no longer considered as necessary for a child to have measles and scarlet-fever as to cut its teeth. It is no longer considered an essential part of life to have at least twenty or thirty days of illness in the year; but the community is beginning to learn that health and happiness are within reach of all who know and obey the laws of right living. Health and happiness mean competence and peace in the community. Good housekeeping and good cooking have the greatest influence on these factors in a nation's prosperity.

The necessity of teaching something of sanitary law is recognized in the wide-spread endeavor to introduce lessons on hygiene and temperance into public schools. But the attempt to teach topics insulated from their proper connections is oftentimes not only futile but disastrous. In these lessons harm instead of good not infrequently results, from ignorance of the real bearing of science as well as from over-zealous partisanship. Hygiene and temperance with a good ground connection in a course in domestic economy may safely receive the shock given by the most enthusiastic teacher.

The elementary science lessons now given in so many schools form an admirable and sufficient ground work for the consideration of the effect of foul air and dust on health.

The present plea is for a connected and systematic course in

general science, which should be given to both boys and girls, as a preparation for the practice work or manual training which is now so generally conceded to be an essential concomitant of an education, as is shown by the establishment of schools where boys may gain control of all their faculties and thus become well-balanced men. It is quite time to consider what can best effect the same result in the same degree for girls.

The subject chosen must be broadly educational, and at the same time capable of manual demonstration. It must be universally applicable to all conditions of life. The writer has no hesitation in saying that the science of domestic economy rightly interpreted fulfils all of these conditions. And here, as in all manual training, the science, or educational element, should be distinguished from the art.

While sympathizing heartily in the work of the cooking schools so successfully established, the writer sees the same element of danger lest they should be considered as an end instead of a means, as has been the case in the schools of carpentry. In a word, they should "not teach how to make a living, but how to live." To do this effectually the foundation should be broadened; just as the course in carpentry has developed into the manual training school, so should the eminently successful cooking school develop into a course in domestic economy. All the work of the school should be in harmony, and the cooking should no longer be considered an outside affair, an interloper, a crowder-out of more important studies, but all the teachers should co-operate to make most effective the practical lessons.

The topics required are all taught in some fashion in most schools, so that this plea is not for the introduction of new subject-matter, but for the simplifying and correlation of what is now attempted, so that the result may be a valuable educational development mentally and morally, instead of a useless hodge-podge of isolated facts, with no effect in the after lives of the pupils.

The attempt to introduce new subjects into an existing curriculum is often like setting up with great labor disconnected posts which enclose nothing and support nothing, instead of building upon a foundation a complete and useful structure. In education each step should follow closely upon the previous one, and the connection between all the branches of a subject should be clearly apparent to the pupil's mind.

What, then, is a feasible plan for a course in domestic economy applicable to public school work? The teacher must bear in mind that the word economy as here used is not synonymous with parsimony. Better living, better health in consequence of better

cooking, mean economy to the State in the general capacity of its citizens; brain workers quite as much as day laborers.

The lessons in domestic economy should extend over four years, from the ages of ten to fourteen or from twelve to sixteen. The writer prefers the younger limit: —

First Year. — Observations on the growth of plants and animals, in the school-room; sewing and knitting; two hours a week of elementary science lessons; the study of oxygen, hydrogen and carbon, and their relation to the life of plants and animals.

Second Year. — Continued observation of plants and animals; collection of seeds and fibres and woods in connection with geographical study; sewing, cutting and fitting; two hours a week of elementary science lessons; simple mechanism; oxygen and carbon, in their relation to fire and heat; elementary physiology.

Third Year. — Completion of the museum of materials used in the house, with reading lessons and geographical classification; one hour a week of elementary science, composition of food, starch, sugar, etc.; two hours a week in the school kitchen; practical lessons in the care of the fire and the cleaning and cooking of natural products, seeds, roots and fruits; simple applications of the laws of heat which have been learned before. Especial attention is to be given at this point to cleanliness, to orderly and systematic arrangement. One hour a week at this point should be given lessons on personal hygiene, temperance in eating, as well as in drinking.

Fourth Year. — Collection of materials used in cleaning and repairing; soaps; substances used in taking out spots and stains; sewing materials; examples of skilled repairing; one hour a week of science lessons, on the composition and cost of food materials and the preparation of dietaries for different seasons of the year; two hours a week in the school kitchen, beginning with the natural products prepared by the younger class; the lessons should be devoted to combining them into the more complicated dishes; the cooking of meats, preparation of soups and stews, the making of bread and breakfast and tea cakes; made-over dishes; suitable combination, seasonable marketing with appetizing serving, should follow; one hour a week, family hygiene and the care of the house.

The course here outlined will in all require only one-fifth of the school time, and surely it is of one-fifth the value of the sum total of education.

The plan proposed is no visionary one; but, lest some reader should still be skeptical about the desirability of the manual or practice work and the introduction of so much science into the school kitchen, we will consider the question more in detail.

The use of tools is acknowledged to be almost a distinguishing attribute of civilized man, that thing which distinguishes him from the savage; and the advocates of manual training often say that there is no reason why girls should not use tools as well as boys; but as a rule the needle is still held to be the tool of the woman, as it was in the day of bead ornamentation and tapestry working. The use of tools is also recommended, because of its value in developing the muscles, in making a part of physical training.

Will any one venture to recommend the position of the seamstress at her work as hygienic? as calculated to develop all parts of the body? as tending to an erect carriage or a firm step? However valuable the use of the needle may be as an art, it cannot claim to be ranked very high as a factor in education.

The preparation for needle-work, the science of cutting and fitting, is properly a branch of drawing and geometrical application, and as such is rightly considered within the scope of the school; but even that is of limited value in increasing physical and mental growth.

The workshop, as arranged in the best schools for manual training, leaves little to be desired in the way of the best exercise for all the muscles; watch a boy at the bench, and see how in the progress of his work every muscle from head to foot is called into play, and with this advantage over the gymnasium, that it is all unconsciously done, the boy's mind being on his work. The mental stimulus which the boy receives from the workshop has been abundantly proven.

What can take the place of the workshop in the education of girls? Educators are everywhere clamoring for physical education for girls as a necessity; and yet no general effort has been made to give the girls a chance at the work bench, although some schools have done so. It is an additional expense, for one thing, and since, after all, the school is utilitarian to a certain extent, that subject which is useful as well as educational will find a readier foothold.

But along with the use of tools in the development of civilized man came another advance, as marked, and not less important, *i. e.*, the cooking of food. In all the march of civilization the two have gone hand in hand. The savage woman built the house as well as cooked the food. Man has taken the building off her hands, but the cooking still remains her province. What training does she receive for this most important office, an office not less important to the welfare of the community than the use of tools?

Can cooking, the use of kitchen tools, be placed on a level with the use of workshop tools, as a means of mental and physical

training? Let the skeptic go into one of the school kitchens and see the girls standing at their benches, with the measuring cup and scales, instead of a foot rule, with the moulding board and rolling pin instead of the plane, the dough for a loaf of bread instead of a piece of pine board, their hands the most effective tool of all. Let him watch their graceful, unstudied motions, as they tidy up the desk while the prepared dish is cooking; let him note their bright faces as the soup is tasted, and then tell whether there is no value in the work as a physical development and a mental exercise in judgment, exactness and neatness, if the "executive faculty, the most important of all our powers in the practical work of life," is not called into play by the bringing of the preparation of materials and cooking within the specified time?

As, in the case of the workshop, after the fundamental principles are learned, the pupil has the satisfaction of making a table or a chest of drawers, in order that he may more clearly see the bearing of each separate process, so the girl prepares a set of dishes, as a tangible evidence that she has understood the principles involved, not merely for the sake of making the dish.

Consider for a moment the scientific principles which are called into play in the preparation of so simple a dish as a steamed pudding. First a fire is built. The kindling point of coal is at so high a temperature that the heat of a match is not sufficient to ignite it, therefore some wood is first set on fire; but this cannot be lighted by the heat of a match unless it is in shavings or fine splinters, which will in their turn give heat enough to set on fire the larger pieces, and this will heat the coal so that it will burn. None of these substances will burn unless they have sufficient oxygen to combine with the carbon and hydrogen which they contain. If they do not burn there will be no heat, hence the amount of air which passes through the wood and coal must be regulated by the drafts of the receptacle in which the combustion is going on, *i. e.*, the stove. Too much air will carry the heat produced by the union of the oxygen and carbon and hydrogen up the chimney. After a fire is well started, steam to cook the pudding is required. A pan of water is set over the fire, and by means of the conducting power of the metal of which the pan is made the water is heated. First little bubbles of air are so expanded by the heat as to rise to the surface and escape; then some of the water nearest the metal is so heated that it becomes gaseous and rises in large bubbles to the top, where the bubbles are cooled to water again, and seen to disappear. Soon, however, the top becomes heated by these bubbles of steam so that they escape as steam, carrying with them the heat which was required to form

them; this heat is given up to any cooler substance with which the steam comes in contact, and so it becomes heated. While the water is coming to this temperature, the dough is to be prepared. Wheat flour is used, because it contains all the substances which are needed for the nutrition of the human body. Starch and some fat to be combined with oxygen in the tissues to furnish the heat needed to keep the body from ten to one hundred degrees warmer than the outside air, according to the season, and to furnish some of the tissues with food which they need. Flour also contains gluten and some other nitrogenous substances, which not only enable the cakes made from flour to become light, *i. e.*, porous, because of its glutinous character, but also to furnish nitrogenous material for the repair of the muscular tissues, and probably to fulfil some other as yet unknown office in the economy of the human body.

The flour being good for food in itself must be made digestible and palatable, the three requisites in any food. Flour being dry must be moistened, therefore water is added in just such quantity as will be taken up by the starch grains and swell them but not allow them to become pasty. But the saliva must penetrate every particle of starch with its change-producing ferment, and, while savage man ate parched grain, chewing it a long time, civilized man prefers a quicker method, and so makes the mass of cooked flour porous with the aid of carbonic acid gas introduced either by the use of a ferment yeast, or more quickly by a chemical preparation of baking powder. When the batter is heated all through to the boiling point of water, 212° F., the gluten is stiffened so that the mass is elastic, the starch has taken up the water and becomes dry. The pudding has now to be taken out and served with some flavored sauce.

The school girl who has had the elements of chemistry and physics, which are often taught as abstract subjects, summed up and applied to the making of a simple dish, has had her mind awakened to the relations and interdependence of things, as no other training now given can awaken it.

The objector may say that a pudding made by practised hands is just as good as one made by the hands which are actuated by all this brain knowledge. It is quite true; but the advocates of manual training as a factor in education turn their eyes first of all, and chiefly, to the effect on the child (not to the results as shown in the work accomplished, for the sake of results only) for the proof that the training has been successful in that which it aimed to accomplish, namely, a result on the mind of the child.

Often the most effective lessons are those which are indirectly learned. Thus not the least of the many values of the training in the cooking school is the indirect one of neatness, cleanliness and promptness.

This effect cannot be better expressed than it has been by a master in science. "A fact discovered by a child for himself through his own direct observation becomes a part of his being, and is infinitely more to him than the same fact learned by heresay or acquired from a lesson book. The idea of discovery should be encouraged in every way among children. We should remember that to them the whole of nature is an unknown world, into which their young souls, timidly or adventurously, as the case may be, advance. If we can help them to push forward boldly and see things for themselves, we do them an inestimable service, not only adding to the joy of their childhood, but kindling for them a light that will illumine them all their future life." *

The training has been so far tried in two different places in the curriculum, in the grammar school and in the high school. At present I am unhesitatingly in favor of beginning at the earlier date. The age of ten or twelve is my own preference, for several reasons : —

First. — The child of ten or twelve is still observant, even if she has been so unfortunate as to miss the early training of the kindergarten. She is still retentive in memory, without effort, especially in regard to things which she sees and handles herself.

Second. — The experience so far gained has shown that, as a rule, the younger children (twelve to fourteen years of age) very readily appreciate and very deftly perform the housekeeping part of the lesson. They wash the dishes and put them in place with a zest which is wanting in the case of the older girls.

Third. — At twelve she needs pleasant bodily occupation, rather than prolonged mental work.

Fourth. — She needs a mental distraction, an interest outside herself, an interest in things and an illustration of the power of mind over matter ; a control of the forces of nature. An inquiry into the reasons of things is of great benefit to the growing girl. At an age when dolls begin to be thrown aside, let the child begin her preparation for womanhood by practising that most fascinating of all rainy-day plays, playing cook, under the eyes of the judicious teacher.

The work to be laid out in the school kitchen corresponds very well with the course in the workshop.

* "The Teaching of Geography," Archibald Geikie, page 8.

First the preparation and the clearing away, the care of the fire, the tidy ways of the kitchen, in short, the housekeeping part. Then the construction of single parts, simple boiling, broiling and baking. Finally the preparation of a whole and its orderly arrangement, mixing, flavoring and combining of dishes. Whether these three parts shall be all combined into one course, or whether there shall be two or three separate courses extending over as many years at less frequent intervals, depends upon circumstances. For the elementary instruction in the grammar school two years at least are needed for the best development of the science. It would then seem wiser to follow the natural order, and arrange for the younger children to take that most essential part of the lessons, the housekeeping part, either as a morning lesson, preparing the materials for the afternoon class to combine into dishes, or a certain number of them to serve at the same time that the other lesson is taking place.

The first plan would seem to be preferable, since all confusion should be avoided and all distraction of the mind from the work in hand. Also there should always be time allowed for the full performance of the work, for, as in all science teaching, the child should never be told what is to happen. She should see for herself what will take place under given conditions.

When, however, one teacher has to oversee two sets of workers, a loss of power is unavoidable. Two teachers, one for each class of workers, would of course solve the difficulty. In any case care must be taken not to crowd too much into a single lesson, and especial care must be taken to have each lesson a preparation for the next, that there may be a clear and orderly progression from beginning to end. There is a limit to the absorbing powers of a child's mind.

If, however, the lessons on domestic economy are delayed until the pupils are in the high school, the first endeavor must be to bring into line whatever of science training they have had; their interest must be awakened in the applications of the laws they have learned in their school laboratories. For them the school kitchen is only another kind of chemical laboratory. They should be already familiar with the use of the thermometer and with the properties of starch and sugar, so that they may at once begin the preparation of food and the study of its composition. In case of a possibility of a three-years course in the high school, the third year should give an opportunity for the class to combine the foods prepared by the other classes into a suitable dinner, with the refinements of service, and with careful calculations as to cost of materials and of preparation.

So little attention has been paid to the science of cooking, there is a wide field here for original work.

In all this discussion the reader will bear in mind that the standpoint is that of the public school, and the aim is an educational one throughout, just as much as if the topic under consideration were the teaching of arithmetic or geometry. It is the development of the child in character, in mental ability, in more strength by means of the training advocated. It is not the production of a skilled class of workers in one line.

This distinction should be borne in mind constantly, because there are trade schools in cookery, just as there are trade schools in carpentry and metal working. Both are admirable for certain purposes, such as giving free instruction to the children of the poor, or affording an opportunity to those who wish to make a better living, or offering advantages to grown people to improve their condition, or opportunities to acquire useful knowledge.

It has been very difficult to prevent the two forces of philanthropy and education from collision over this matter; and, at the risk of being tedious, the writer must emphasize the distinction again as a reason for the comprehensiveness of the course on domestic economy, which at first sight may seem to be absurdly extended so as to cover all the sciences. But where do all the sciences meet, if not in the home, the centre of all activity, the pivot about which revolve comfort, health and happiness, or sickness, poverty and heartache? Upon the education of the American school girl depends the future of the American home.

The science of home life should keep pace with the improvements in outside affairs. At a time when all the food products of the world may be found in the markets of any city, and when electric lighting and steam heating are common in dwellings, the housekeeper needs a correspondingly broadened education.

At present it will be difficult to find teachers fully equipped for carrying out the ideal course in domestic economy, but the demand will bring the supply. Colleges and scientific schools are waking up to the needs of the times, and courses in physiology, hygiene and sanitary science are being established, with reference to the requirements of such teaching.

APPENDIX.

New Jersey State Board of Education.*

Cooking.—Instruction in cooking may be begun in the lowest grammar grade. Instruction in cooking should be connected as much as

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* Extract from the report of the special committee on manual training, submitted Feb. 7, 1889.

possible with instruction in other subjects. In schools where natural science is taught, a particularly close connection can be established.

The instruction begins with the making and care of fires and the chemistry of combustion; then proceeds to the principles and practice of food preparation, by boiling, broiling, stewing, roasting, etc. The class-room work should include talks on the chemistry of foods, the relative nutritive power of various foods, and questions of food economy, etc.

The instruction should be given twice a week, in lessons an hour in length, throughout the grammar grade. A room must be set apart and fitted up for this instruction. A class of twenty can be easily instructed at one time, and the cost of equipment for such a class is about eighty dollars. The materials used will cost on an average one dollar per lesson.

Boston, Mass.

The school committee having voted to permit girls of certain schools to attend the schools of cookery established in North Bennet Street and Tennyson Street, provided that the parents or guardians of the pupils so request in writing, it was decided that such pupils should attend the cookery schools on probation, and under certain regulations prescribed by the committee on manual training schools. Among these regulations are the following: —

These schools shall be under the general direction of the committee on manual training schools so far as the attendance of classes from the public schools is concerned.

The morning sessions of the schools of cookery shall begin at a quarter-past nine o'clock and close at twelve o'clock; the afternoon sessions shall begin at two o'clock and close at four o'clock.

Fifteen pupils shall be the standard number to one class. The classes will alternate morning and afternoon sessions.

The discipline of the Boston School Kitchen No. 1 shall be under the direction of the principal of the Winthrop district, and the discipline of the North Bennet Street School shall be under the direction of the principal of the Hancock district. Any disorderly conduct on the part of pupils shall be reported to the principals of the schools from which such pupils come.

The absence of pupils shall be reported to the principals of the schools from which they come, and shall be recorded as absences from the regular classes of the grammar schools to which such pupils belong.

The tardiness of pupils shall be reported to the principals of the schools from which they come.

Each principal shall send to the teachers of the schools of cookery class rolls containing the names, ages and residences of the pupils in each class sent from his school.

Pupils attending the schools of cookery must have sufficient intelligence to keep a recipe book.

New Haven, Conn.*

Cooking.—When, one year ago, it was suggested that the board add instruction for girls in domestic economy, it seemed hardly possible that a public sentiment would be developed sufficiently strong to secure the necessary action. But such has been the case, and Miss Emma Polson, who has taught classes the past year with marked success at the rooms of the Young Women's Christian Association, has been secured as instructor. The ladies of the above-named association having tendered the use of the rooms at a nominal rent, the board voted to try the experiment there, and appropriated one thousand dollars for that purpose. Classes of girls will attend one-half day each week from the ten grammar schools in the same manner as the boys attend the manual training school.

These several forms of industrial education may all be considered as valuable in two ways: (1) for *mental discipline*, (2) for *practical utility.* While it might be difficult to justify them for the latter reason, it is the prevalent opinion that they can be defended on educational grounds. That wood-working, sewing and cooking are of immense practical importance is certainly no argument *against* their adoption as an integral part of a school training.

It may be admitted that during one period in the history of schools it was permitted to teach anything but what was immediately useful. That time has passed. It is now conceded that if the useful arts can be taught so systematically as to train and discipline the highest powers of mind and character, there is no sound reason for neglecting them. It is moreover agreed that the best interests of human society and the welfare of the State as related to thrift, industry and morality require that something be done in the schools to establish good habits and stimulate the domestic virtues. During the past year the cities of Boston, Springfield, New York, Philadelphia, Baltimore and Washington have made rapid progress in providing facilities for instruction in manual arts. In countries abroad, still more complete and thorough provision is being made in this line. England, Belgium and France have taken important steps toward giving an industrial character to public education. These facts are straws to indicate the drift of public opinion. Is it not possible that we still have much to learn and much to accomplish before we have a perfect and complete school system?

New York City.†

Resolved, That in the girls' grammar schools cooking should be taught in the third and second grades.

Resolved, That the instruction in cooking should be under the direction of special teachers, who should be licensed, employed and paid in the manner now provided for special teachers.

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* Extract from the report of Superintendent S. T. Dutton for 1888.

† Extract from a report on "Manual Training in the Common Schools," submitted to the Board of Education by the committee on the course of study and school books, June 29, 1887.

A. Estimate of expense (not including salaries of new teachers or expense of supervision) of introducing manual training, as recommended, into all the schools, and maintenance the first year: kitchen outfit, $200 per department, sixty departments, $12,000; kitchen supplies, $100 per department, sixty departments, $6,000.

B. Estimated expense (not including salaries of new teachers or expense of supervision) of maintenance of manual training in all the schools in the next succeeding years: kitchen, ten per cent. of outfit, $1,200; kitchen supplies, $6,000.

New York College for the Training of Teachers.*

Department of Domestic Economy.

The instruction in this department includes cooking and sewing. The primary objects of the cooking course are to stimulate investigation, to develop the power of accurate observation and to lead the pupils to put to practical use in the preparation of food their knowledge of the natural sciences. Throughout the entire course the students are instructed in chemistry of cooking and food nutrition, by means of lectures illustrated by charts and a food-museum. There is also a prescribed course of reading and lectures on domestic economy, including all matters relating to the care and hygiene of the household. There are no demonstration lessons, the work in the cooking laboratory being entirely practical. The course of study includes ten lessons on each of the following subjects: the principles of cooking, with practical illustrations, plain cooking, preparation of fancy dishes, cooking for the sick, and a course of lessons intended to teach the most economical methods of choosing and preparing food. This course occupies four periods a week during the senior year.

Model School.

Grammar Grade. — Cooking is begun in this grade, and includes some information regarding the chemical composition and relative nutritive power of various foods; combustion and the making of a fire; measuring materials and the elements of cookery; the application of this knowledge in the making of bread, soups, biscuits, tea, coffee, etc., and in the proper methods of preparing fish, meats and vegetables for use as food.

Institute of Technology, Boston, Mass.

Instruction of great value is given in sanitary chemistry in a course which consists mainly of laboratory work. A special laboratory has been equipped for the purpose. For all who choose to pursue the subject, a minimum amount of work is laid out, consisting of a study of the methods in common use for the chemical examination of air and water, of milk and of butter. Subsequently opportunity is afforded for the critical study of other methods of analysis, for the examination of other articles of food, and for the investigation of a variety of sanitary problems in which chemical questions are involved.

* Extract from Circular of Information for 1889.

VILLE DE PARIS. (ÉCOLES PRIMAIRES COMMUNALES DE FILLES.)

Économie Domestique et Hygiène.

COURS SUPÉRIEUR.

Une leçon de trois quarts d'heure par semaine pendant laquelle les élèves pourront, tout en écoutant le professeur, se livrer à des travaux de couture.

Premier Trimestre.

Économie Domestique.

Definition de l'économie domestique.

Devoirs d'une maîtresse de maison.

Qualitiés d'une bonne ménagère : ordre, économie, propreté, vigilance, etc.

Budget.

Comptabilité du ménage : carnet journalier, balance, équilibre du budget.

Inventaire du mobilier.

Loyer, Impôts. Engagement de location ; bail, congé.

Hygiène.

Définition de l'hygiène.

Hygiène de l'habitation.

Choix de l'habitation ; exposition, salubrité.

Ventilation, aèration.

Entretien de l'habitation et du mobilier au point de vue sanitaire.

Deuxième Trimestre.

Mobilier de l'appartement ; choix et entretien.

Distribution du travail de la ménagère.

Travaux d'entretien par jour, par semaine, par sason, etc.

Conseils sur la manière de faire un lit, de balayer, d' épousseter, etc.

Meubles et ustensiles de cuisine, différantes espèces de fourneaux.

Allumage des feux.

Entretien et allumage des lampes.

Entretien des ustensiles de cuisine, de la vaisselle, etc.

Combustible. — Donner les indications économiques sur les differantes sortes de combustible, sur leur emploi.

De la Cave. — Exposition, aménagement, soins à donner au vin, conservation.

Chauffage et éclairage au point de vue de l'hygiène.

Aération des locaux pourvus d'un appareil de chauffage.

Dangers des poèles dans les chambres à coucher, précautions à prendre.

Propriétés des différantes espèces de combustibles, de leur influence sur l'appareil respiratoire.

Divers modes d'éclairage.

Des précautions à prendre dans l'emploi des lampes à essences minérales, des appareils à gay, etc.

Influence de l'éclairage sur la vue. Hygiène de la vue.

Troisième Trimestre.

Choix et entretien du linge et des vêtements.

Matérial nécessaire aux travaux de couture.

Emploi de la machine à coudre.

Confection du linge et des vêtements.

Raccomodages divers: reprisage, rapiéçage, etc.

Blanchissage. — Matériel nécessaire au blanchissage et au repassage. Des différants modes de blanchissage, lessive, savonnage.

Conseils pour laver le linge, le plier, le repasser.

Des différantes sortes de taches et de la manière de les enlever.

Hygiène du vêtement.

Propriétés diverses des tissuê: soie, lainè, coton, toile, etc.

Couleurs des vêtements, leur influence.

De la forme des vêtementê au point de vue de l'hygiène.

Propreté du linge et des vêtements, son influence sur la santé.

Le professeur rendra aisément cette leçon attrayante: elle doit reposer l'élève des études plus difficiles et plus abstraites qui exigent un effort soutenu de l'esprit. L'économie domestique est en quelque sorte la relation journalière des occupations de la femme dans son ménage. Presque toutes les jeunes filles reconnaîtront dans ces leçons les principes qu'elles voient appliquer chaque jour dans leur famille; mais sur lesquels il faut insister pour les leur faire observer. Rien n'est nouveau, par conséquent rien ne sera difficile pour elles dans cette science toute féminine qui paraît si naturelle à la femme qu'on s'étonnerait presque de devoir la lui enseigner.

Nous conseillons au professeur d'accompagner ses leçons d'exemples pris dans la vie usuelle et de parler aux yeux des élèves au moyen de dessins exécutés sur le tableau noir.

COURS COMPLÉMENTAIRES.

Une leçon de une heure et demie par semaine.

Premier Trimestre.

Économie Domestique.

Revision des matières etudiées pendant l'année précédente au cours superieur.

Hygiène.

Revision des matières etudiées pendant l'année précédante au cours superieur.

Deuxième Trimestre.

Alimentation.

Viandes de Boucherie. Volaille, gibier, poisson, lait, beurre, oeufs. } Choix et qualite.

Boissons. — Vin, bière, cidre, eau potable.

Hygiène de l'alimentation.

Propriétés nutritives des aliments, leur digestibilité.

Boissons; alcools. — De la sobriété.

Principes élémentaires de la cuisine. Pot-au-feu, ròti, sauces et assaisonneménts, cuisson des légumes.

Provisions du ménage.

Beurre, oeufs, huiles, etc. ; confitures et conserves.

Conservation des légumes et des fruits.

De l'usage des fruits. Précautions à prendre en cas d'épidémie.

Danger des fruits verts.

Falsification des aliments.

Troisième Trimestre.

Du jardinage. Son utilité et son agrèment.

De l'utilité des engrais.

Distribution du jardin. Culture des arbrés, des légumes, et des fleurs.

Le Jardin médicinal.

Savoir vivre. Des lettres officielles, pétitions, etc.

Conseils pour quèlques cérémonies

Hygiène du corps. — Ablutions, bains, soins de propreté.

Sommeil, exercise, repos.

Préparation de tisanes et de quelques médicaments.

Petite pharmacie du ménage.

Precautions à prendre en cas d' epidémies.

Vaccination et revaccination.

Maladies et accidents

Soins à donner aux maladies et aux convalescents.

Dans ces leçons théoriques d'économie domestique, le professeur devra faire intervenir les élèves qui sont exercées à tour de rôle à l'enseignment pratique du ménage (chaque jeudi, par série de dix pour la cuisine, et dix pour le blanchissage et repassage). Il leur demandera d'expliquer à haute voix, à leurs compagnes, les opérations de cuisine et de blanchissage auxquelles elles auront pris part dans la leçon précédente. Cet exercice aura le double but d'habituer les élèves à s'expliquer clairement sur des questions simples et faciles, en même temps qu'il les forcera à prèter plus d'attention à des opèrations qu'elles s'attendront à décrire devant toute une classe.

COURS D' APPLICATION.

Cuisine — Nettoyages — Blanchissage.

Ces cours ont pour but de compléter par des exercices pratiques les notions théoriques donneés aux jeunes filles dans le cours d'économie domestique, de leur en montrer l'application et de leur donner le goût, sinon le science complète du menage, si nécessaire à toutes les femmes. A l'aide de ces leçons et des principes qu'elles y auront puisés, elles pourront rendre des services dans leur famille et perfectionner par l'experience et par la pratique les premières connaissances qu'elles auront acquises.

Les cour d'application ont lieu le jeudi, de huit heures et demie à deux heures, du 1er octobre au 1er juin dans toutes les écoles qui possèdent un cours complémentaire.

Division en Deux Cours. — Ils se divisent en deux cours : 1° *L'e cours*

de cuisine, confié à une maitresse cuisinière ; 2° *Le cours de blanchissage*, *repassage*, *nettoyages*, *etc.*, confié à une maitresse blanchisseuse.

Ces deux cours sont dirigés et surveillés par deux des adjointes *chargèes du cours complèmentaire.*

Durèe de Chaque Série de Cours. — Chacun de ces cours sera suivi par dix élèves environ et comprendra huit leçons. Sa durée est donc de deux mois par série de vingt élèves.

Les élèves des cours de cuisine passeront au cours de blanchissage au bout des deux mois de cours et réciproquement, de façon à prendre part, en quatre mois à tous les exercices du cours de cuisine et du cours de blanchissage. Du 1er octobre au 1er juin, quarante élèves environ devront donc recevoir l'enseignement ménager.

Local. — Le cours de blanchissage et de repassage pourra avoir lieu dans le préau couvert. On y aménagera des tables sur des tréteaux, des planches à repasser, des fourneaux à gaz pour chauffer les fers, des baquets pour laver le linge, une armoire pour renfermer l'outillage. Le matériel volant sera enlevé après chaque leçon.

Il serait à désirer qu'une pièce spéciale fùt affectée à l'enseignement de la cuisine. A défaut de cetta pièce, il faudra se contenter de la, cantine de l'école, à condition que cette cantine soit assez vaste, bien aérée, bien éclairée et en dehors du logement de la concierge. Il sera nécessaire de ménager dans cette cantine une space spécialement réservé aux ustensiles de la cuisine du jeudi, qui ne doivent en aucun cas servir à la cantinière, et d'y placer une armoire fermant à clef pour y serrer la vaisselle et les provisions dé menage.

Cours de Cuisinc. — Le cours de cuisine comprendra l'achat des provisions nécessaires au déjeuner et dont la liste est fixée d'avance par le menu du jour,* la tenue du carnet de dépenses, la préparation et la cuisson des aliments, la mise du couvert. Toutes ces operations devront être décrites au fur et à mesure de leur exécution. Cette première partie de la leçon durera de huit heures et demie à midi. Les élèves, ainsi que la maitresse, déjeuneront ensuite et jugeront ellesmèmes de la qualité des mets confectionnés par elles. (Elles apporteront de chez elles leur pain et leur vin.)†

Apres le déjeuner, tout devra ètre remis en ordre, la vaisselle lavée, les ustensiles de cuisine nettoyés. Les deux maîtresses adjointes feront chacune pour la section qu'elle aura surveillée un resumé oral des opérations du jour pendant lequel les élèves prendront des notes, qu'elles auront à rédiger pour la leçon suivante en les accompagnant du compte de la dépense et du prix de revient de chaque plat par convive.

On trouvera plus loin huit menus d'été et huit menus d'hiver. On y verra désignés des accommodements de viandes froides tels que : miroton, hachis, croquettes, etc. Ces accommodements des restes de la veille sont si nécessaires dans un ménage que l'on ne devra pas s'arrêter à la difficulté qu'ils présentent nécessairement dans un cours qui n'a lieu

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* Trois élèves accompagnées de la maitresse cuisinière et sous la surveillance d'une maitresse adjointe iront chaque jendi faire les provisions du jour.

† Les dix élèves du cours de blanchissage devront apporter leur dejeuner.

qu'une fois par semaine. Un pot-au-feu, fait le mercredi à la cantine de l'école, permettra de conserver pour le lendemain un morceau de boeuf bouilli qui sera accommodé par les élèves de la classe de cuisine.

Cours de blanchissage et de nettoyage. — L'emploi du temps des cours de blanchissage et de nettoyages, est également réglé pour chaque leçon. La directrice de l'école comprendra la nécessité de procurer aux élèves quelques objets mobiliers à nettoyer. Le matériel de l'école en fournira d'ailleurs em certain nombre.

Chavue élève de ce cours apportera les quelques objets de linge qu'elle devra laver et repasser.

Purdue University, Lafayette, Ind.*

SCHOOL OF DOMESTIC ECONOMY, 1887–88.

First Term, Freshman Year.

Oct. 3. LECTURE. — *Home making.*
4. LECTURE. — *Our kitchen interests.*
5. LECTURE. — *The art of cooking.*
6. LECTURE. — *Bread making.*
10. PRACTICE. — Bread making, including yeast, ferment, dough.
17. PRACTICE. — Fermentation of dough, baking of dough, cooking and care of bread.
24. PRACTICE. — Graham bread, fancy rolls and twists; German coffee cake.
31. LECTURE. — *Boiling, simmering, stewing.*
Nov. 7. PRACTICE. — Soup stock, beef tea, plain soup.
14. PRACTICE. — Boiling meats and vegetables.
21. PRACTICE. — Stewing meats and vegetables.
28. LECTURE. — *Broiling and roasting.*
Dec. 5. PRACTICE. — Broiling meats and poultry.
12. PRACTICE. — Dressing poultry, larding.
19. PRACTICE. — Dressing meats and poultry.

Second Term, Sophomore Year.

Jan. 9. PRACTICE. — Making omelets, and cooking eggs.
16. PRACTICE. — Cooking cereals, and making coffee, tea and chocolate.
23. LECTURE. — *Frying.*
30. PRACTICE. — Frying oysters, ham, chicken, potatoes and mush.
Feb. 6. PRACTICE. — Baking, boiling, frying and scalloping fish.
13. PRACTICE. — Making fruit, custard and English pies.
20. PRACTICE. — Making puddings, and pudding sauces.
27. LECTURE. — *Mixing and seasoning.*
March 5. PRACTICE. — Making chicken, vegetable and fruit salads.
12. PRACTICE. — Making croquettes, stews and hashes.
19. PRACTICE. — Setting tables, and serving food.

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* Extract from Annual Catalogue.

Third term, Junior Year.

March	26.	LECTURE. — *Household management.*
April	2.	PRACTICE. — Housework.
	9.	PRACTICE. — Laundry work.
	16.	PRACTICE. — Selecting meats and family supplies.
	23.	PRACTICE. — Handling milk and cream, making and taking care of butter.
	30.	PRACTICE. — Boning turkey and chicken.
May	7.	PRACTICE. — Making cake.
	14.	PRACTICE. — Delicate desserts.
	21.	PRACTICE. — Making candy.
	28.	LECTURE. — *Social etiquette and usages of society.*
June	4.	PRACTICE. — A high tea and sociable.

This work may be taken by students already in the University, without interfering with their regular course of study.

A special course of instruction will be arranged for those who desire to come to the University and devote their entire time to the study and practice of domestic economy. This special course will include daily instruction and practice for a term of eleven weeks, commencing Jan. 9, 1888.

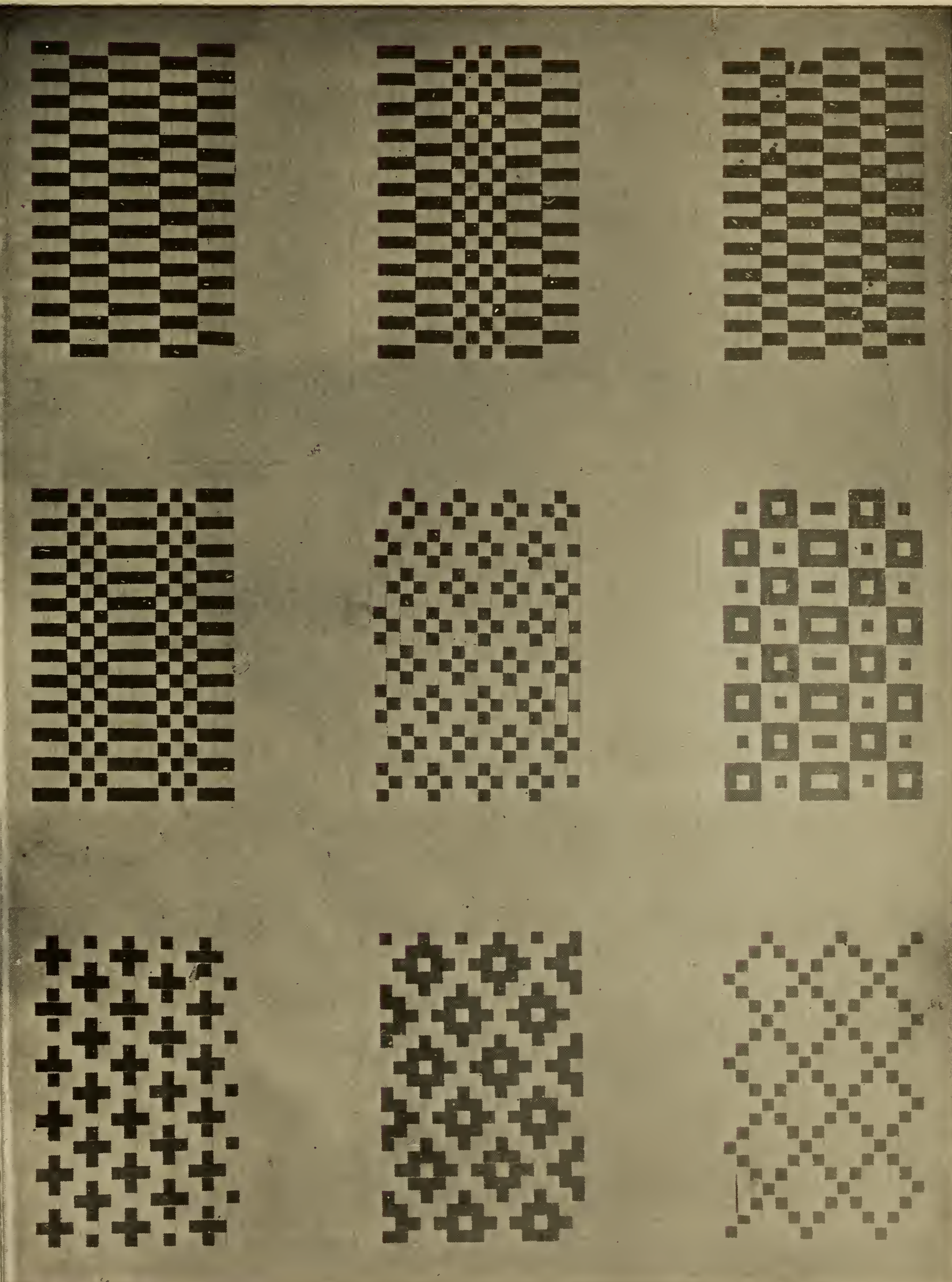


Plate XVI.

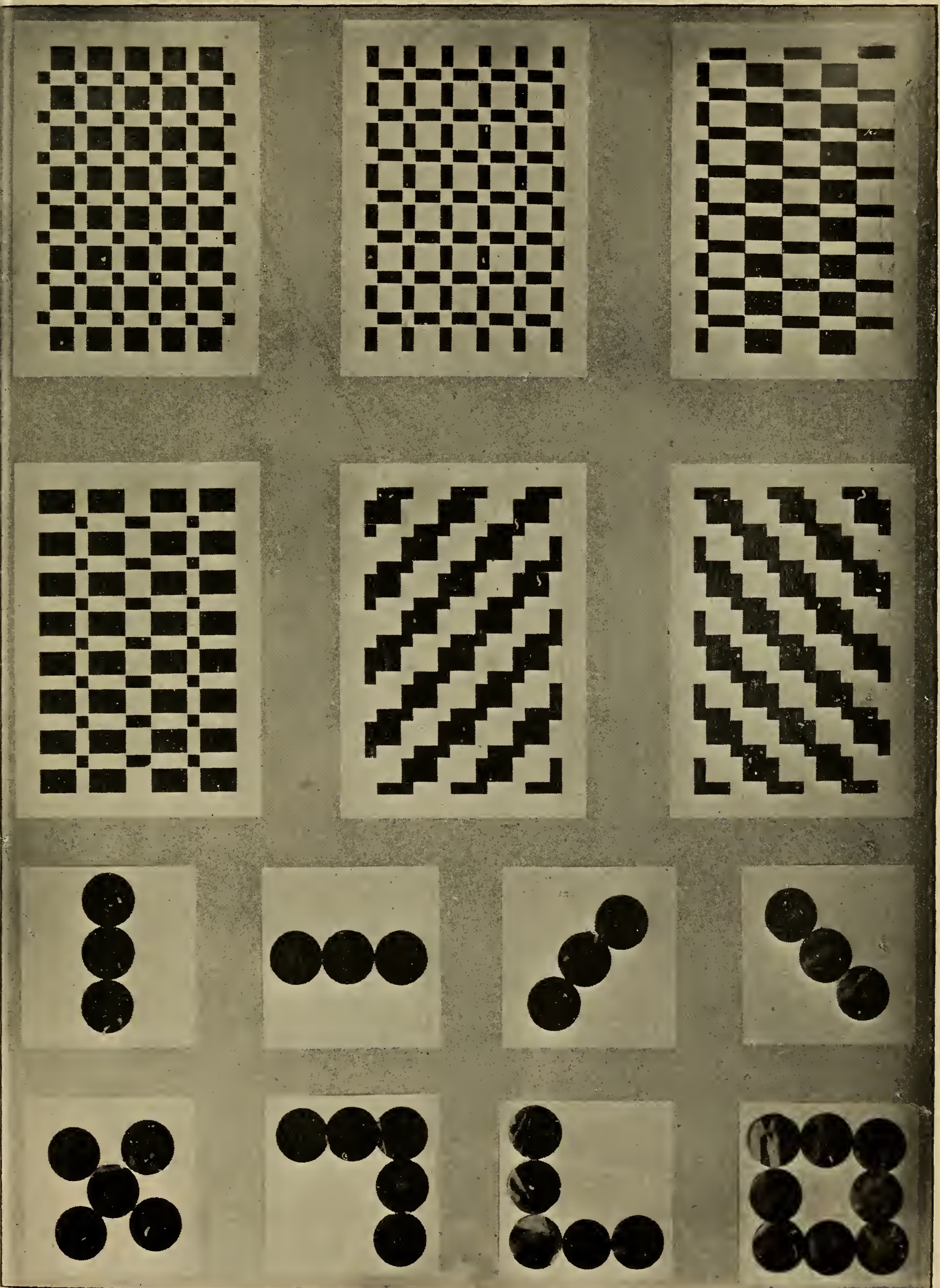
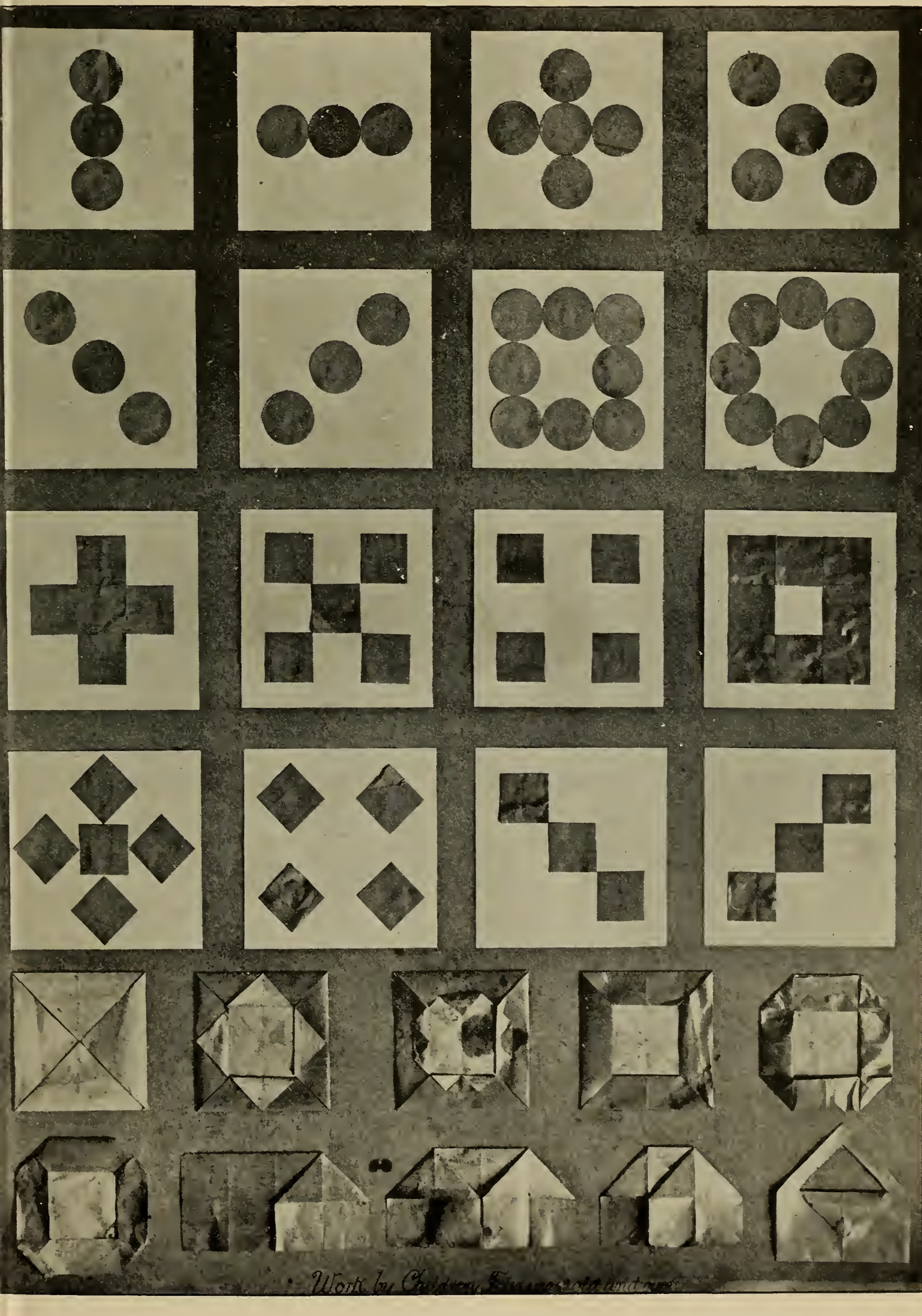


Plate XVII.



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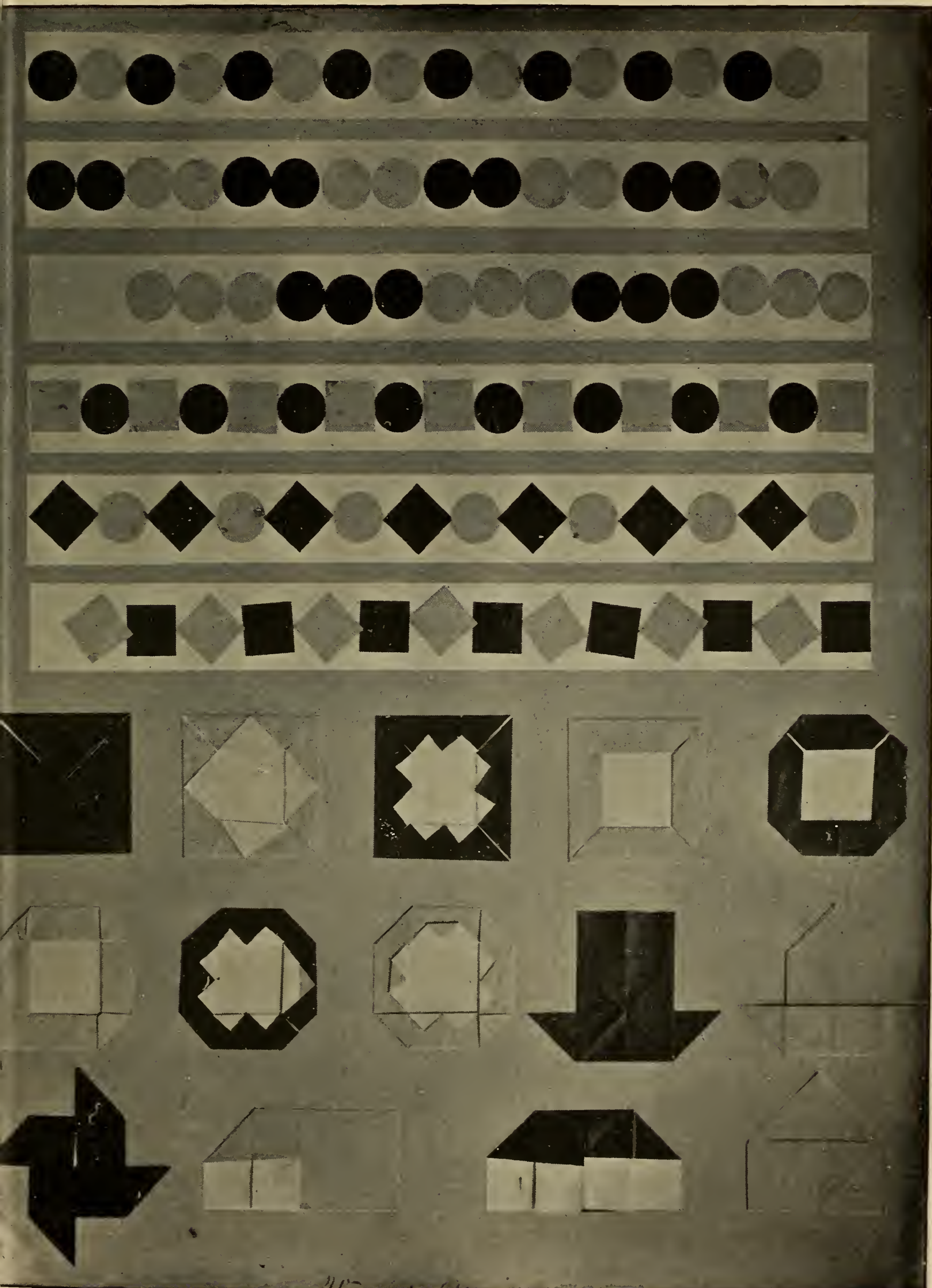

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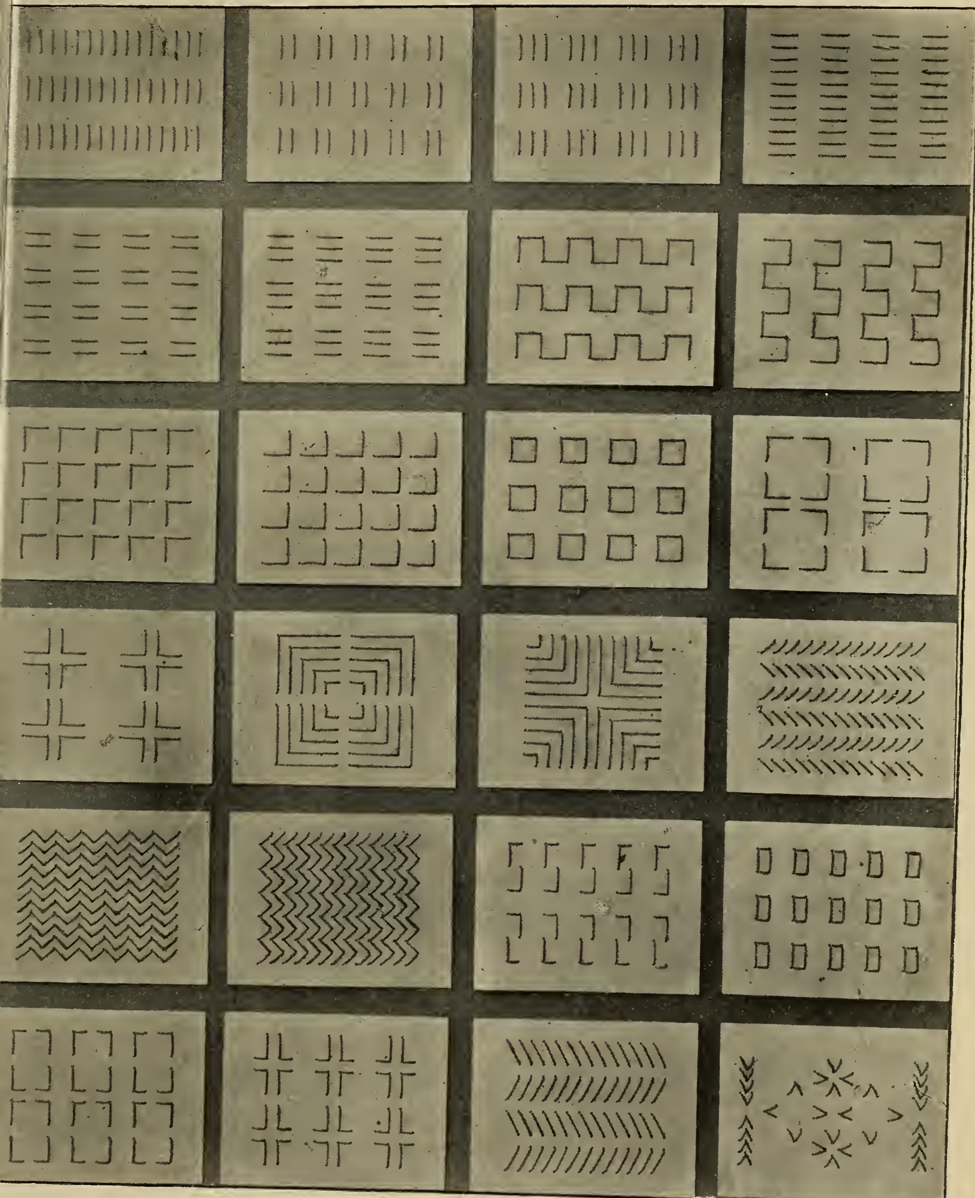


Plate XX.

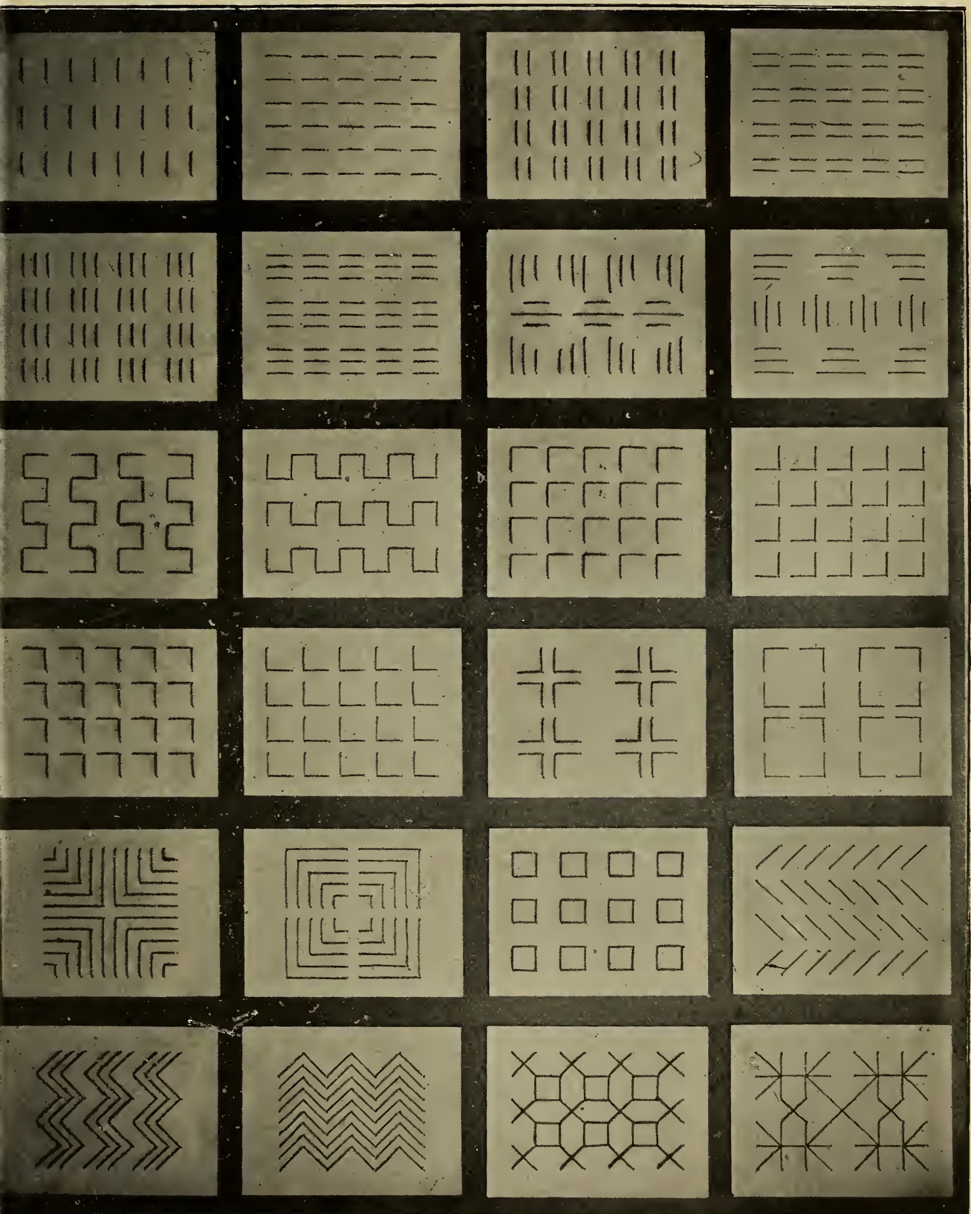


Plate XXI.

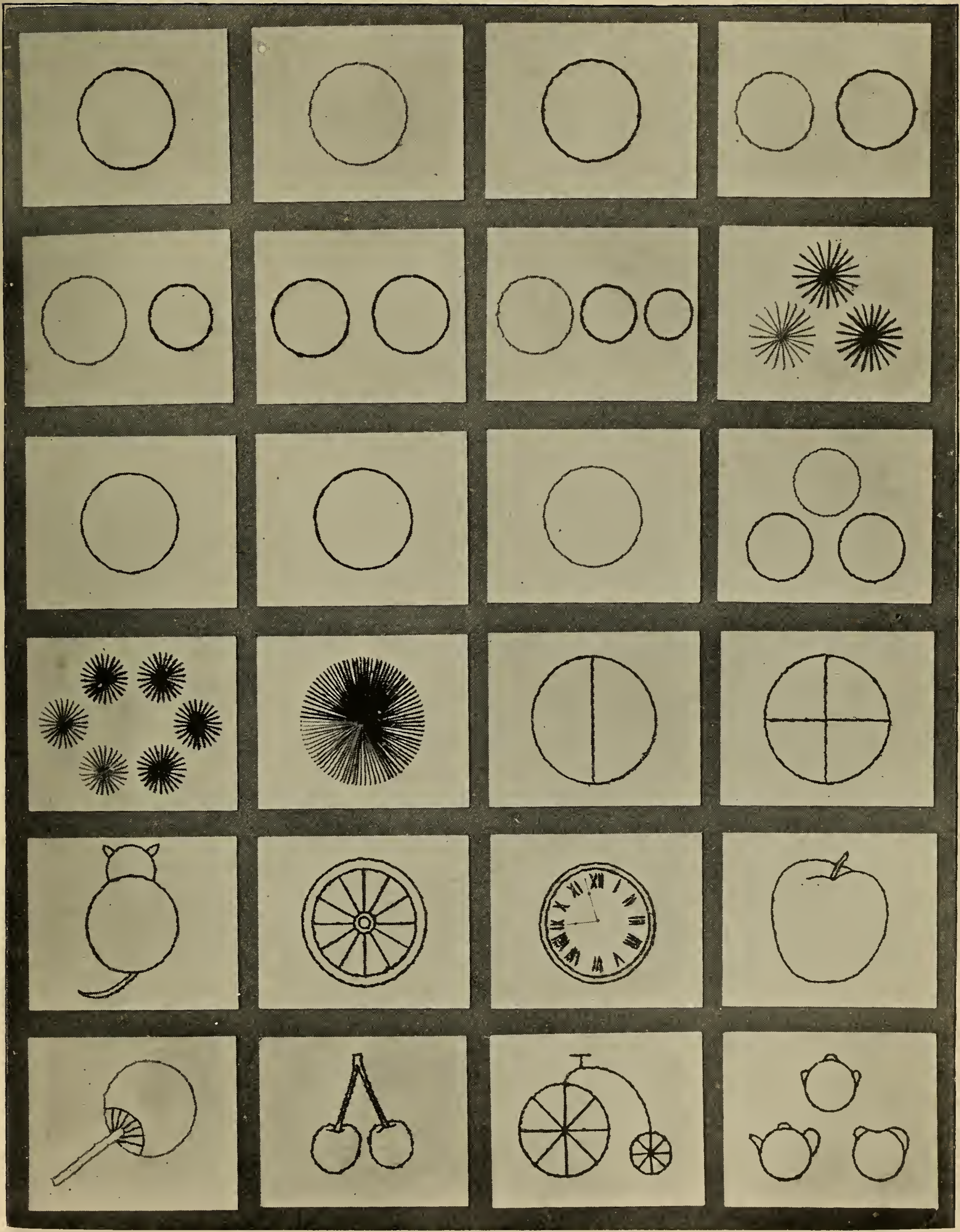
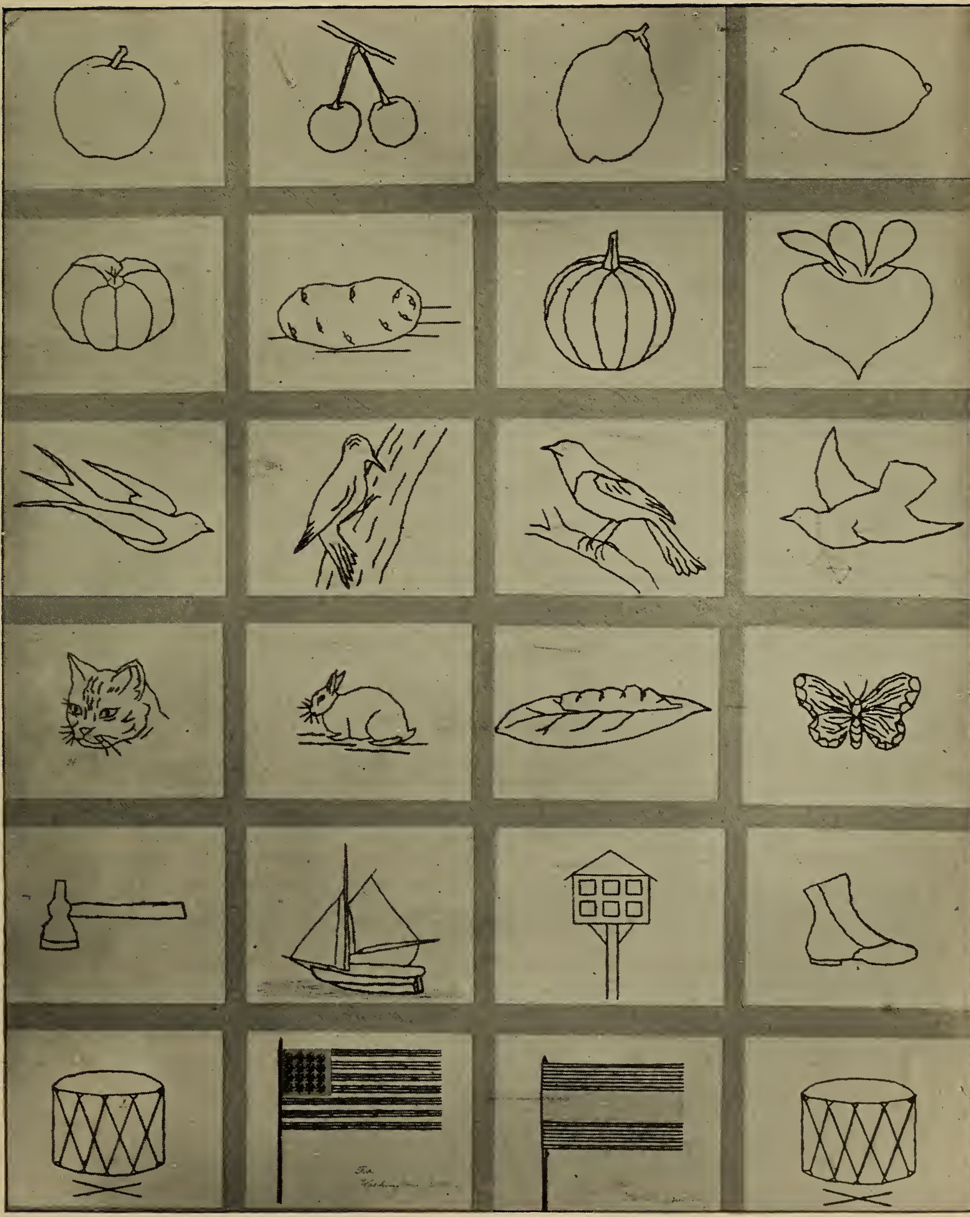


Plate XXII.



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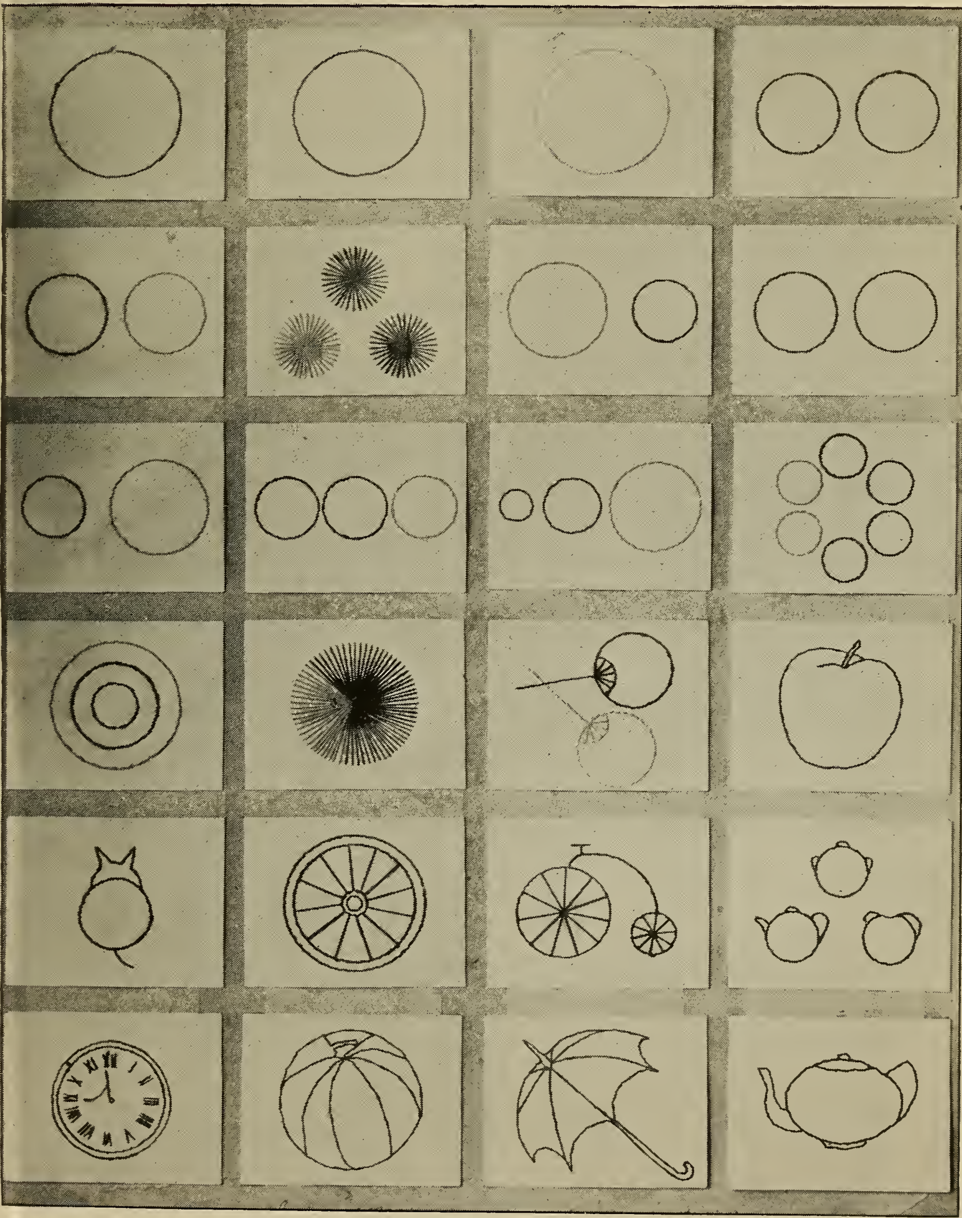
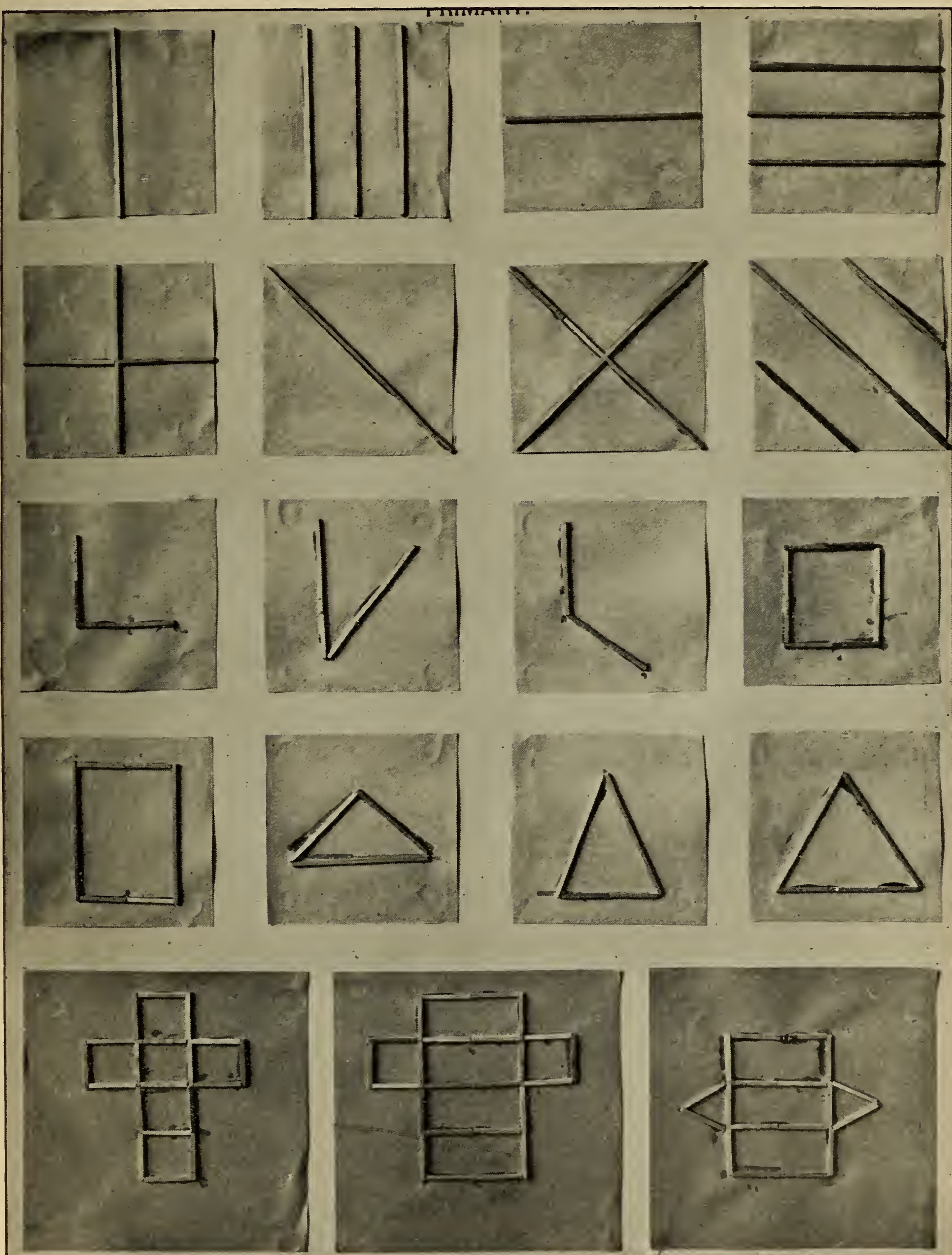


Plate XXIV.

Plate XXV.



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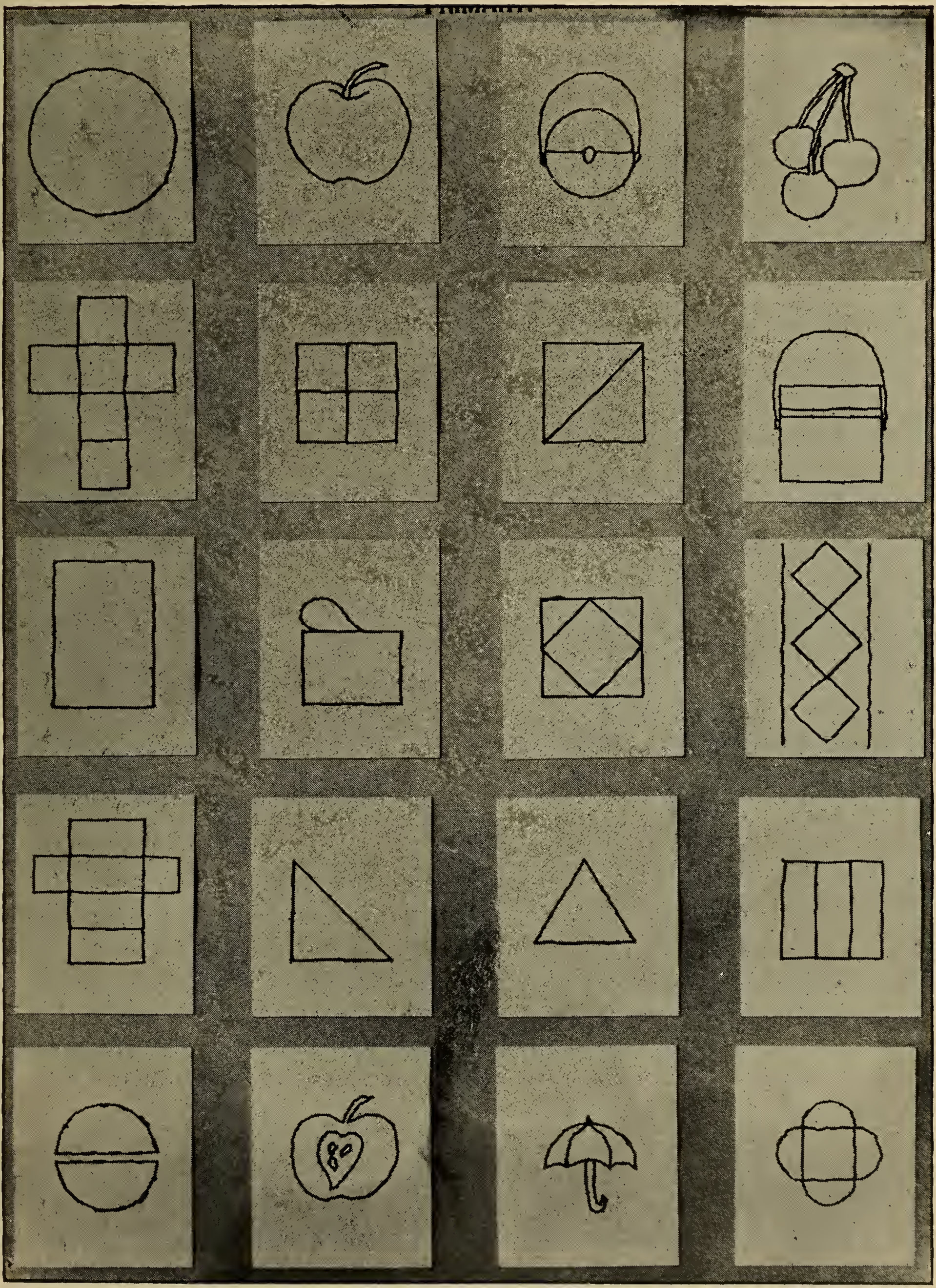

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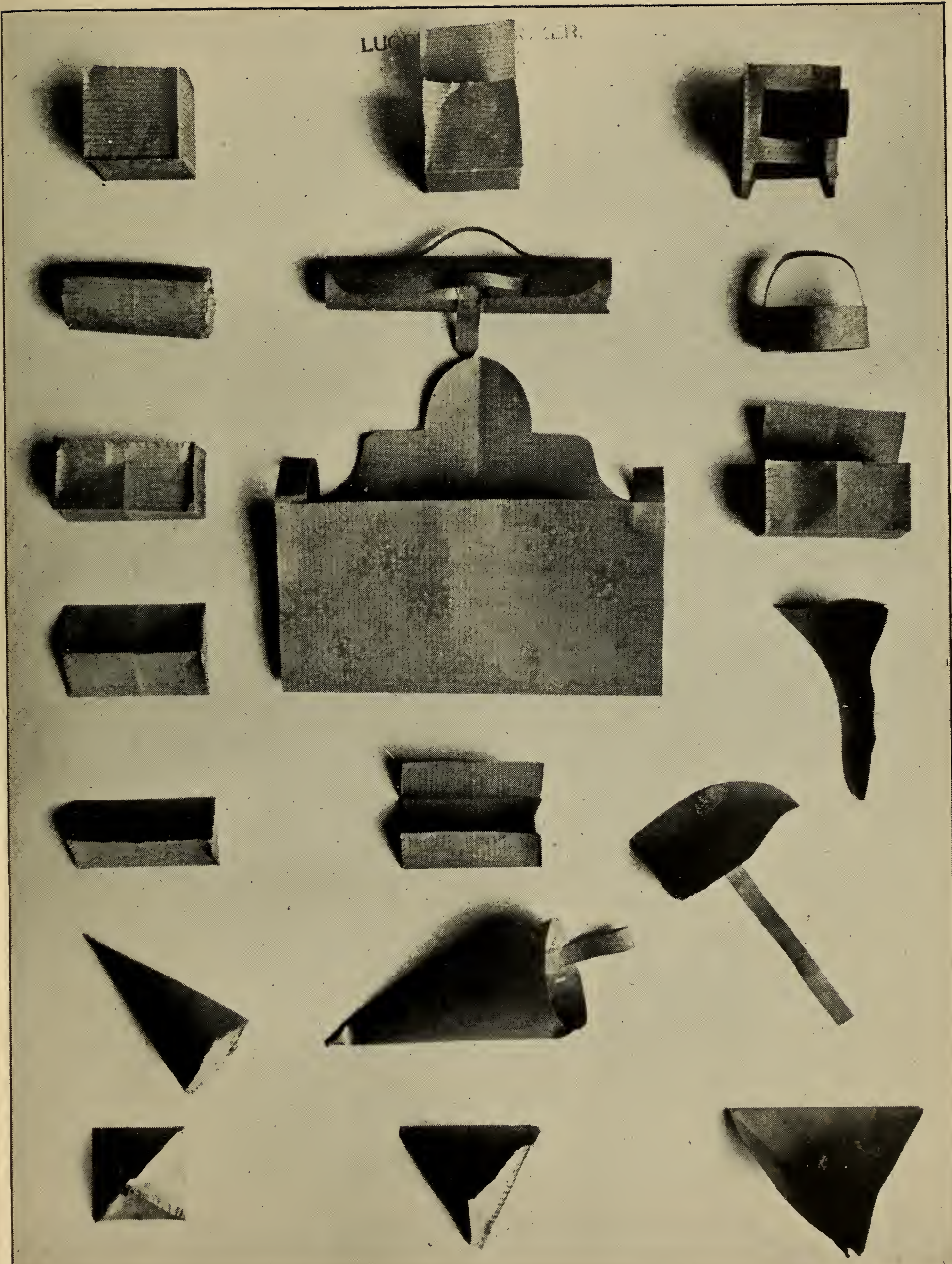
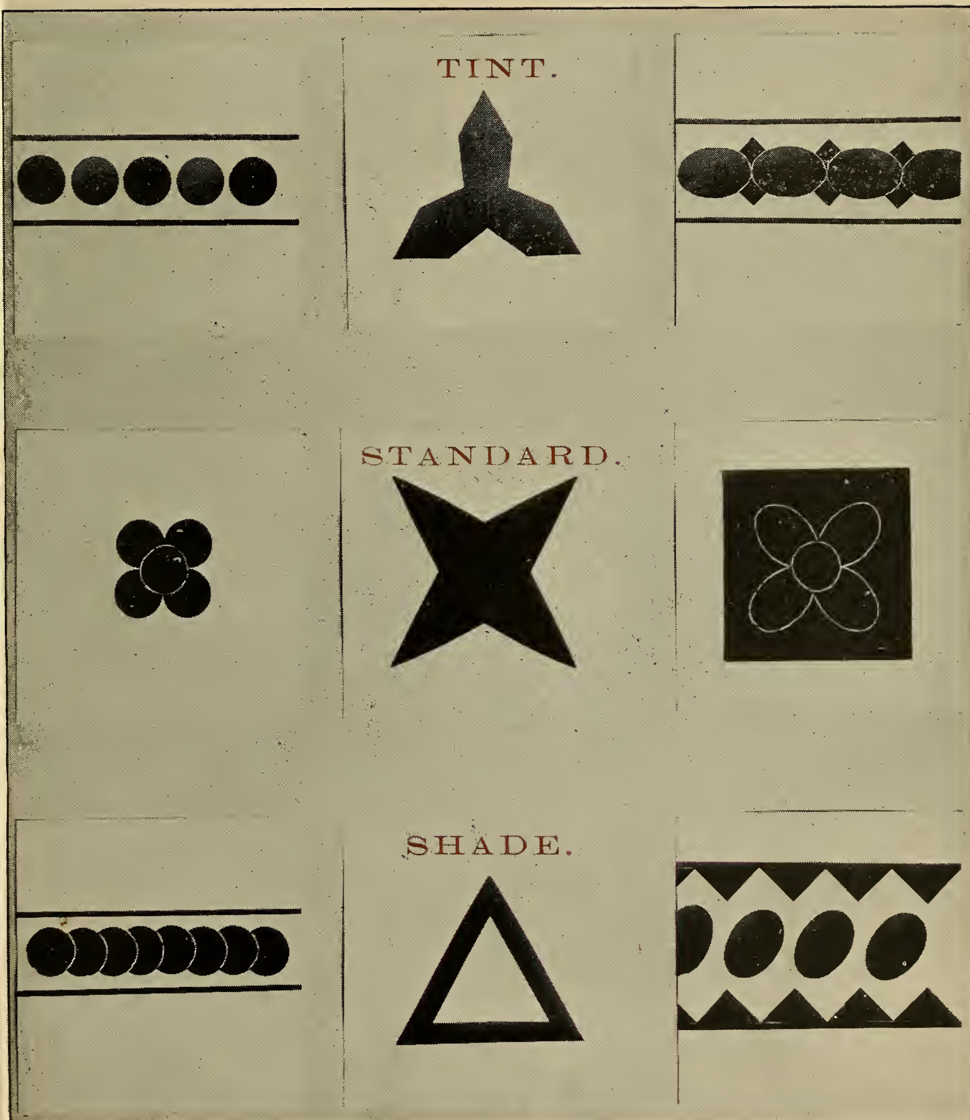


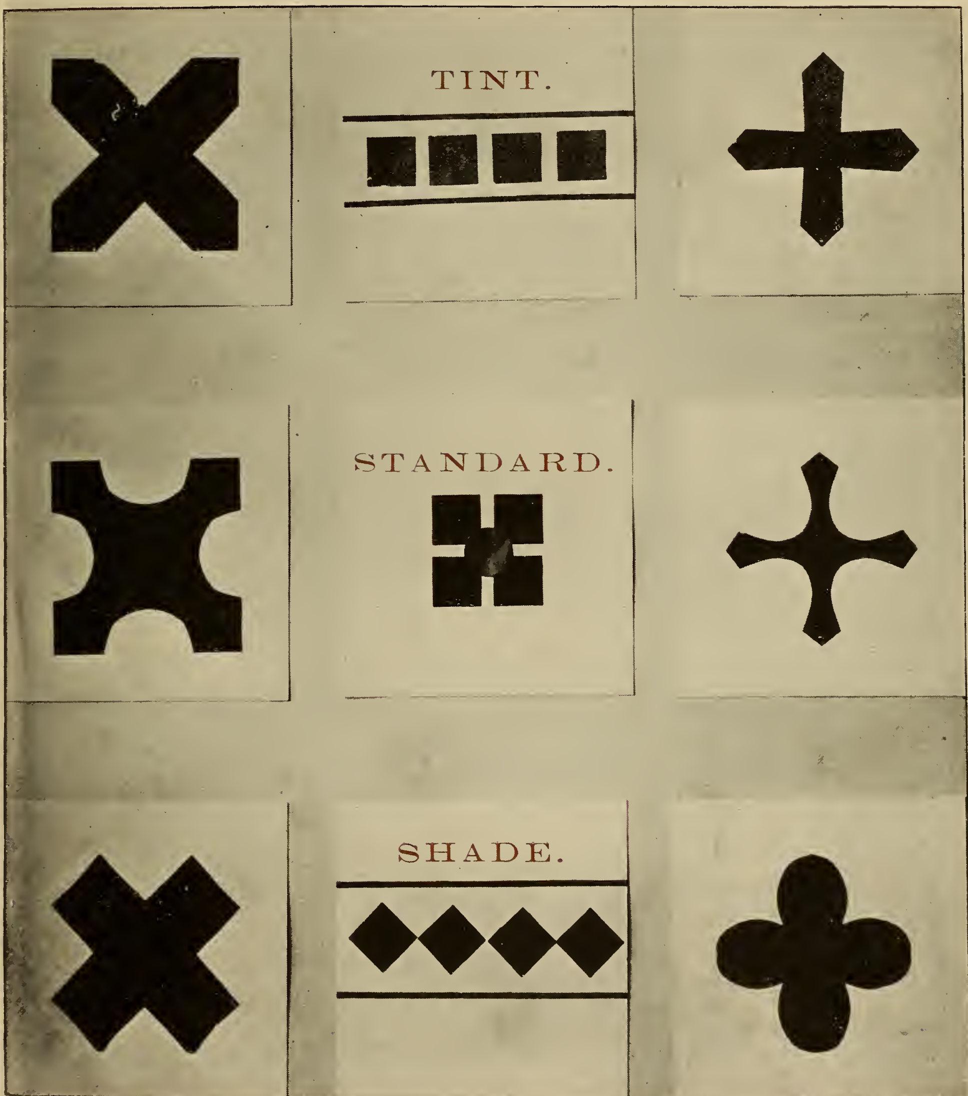
Plate XXVIII.

Plate XXIX.



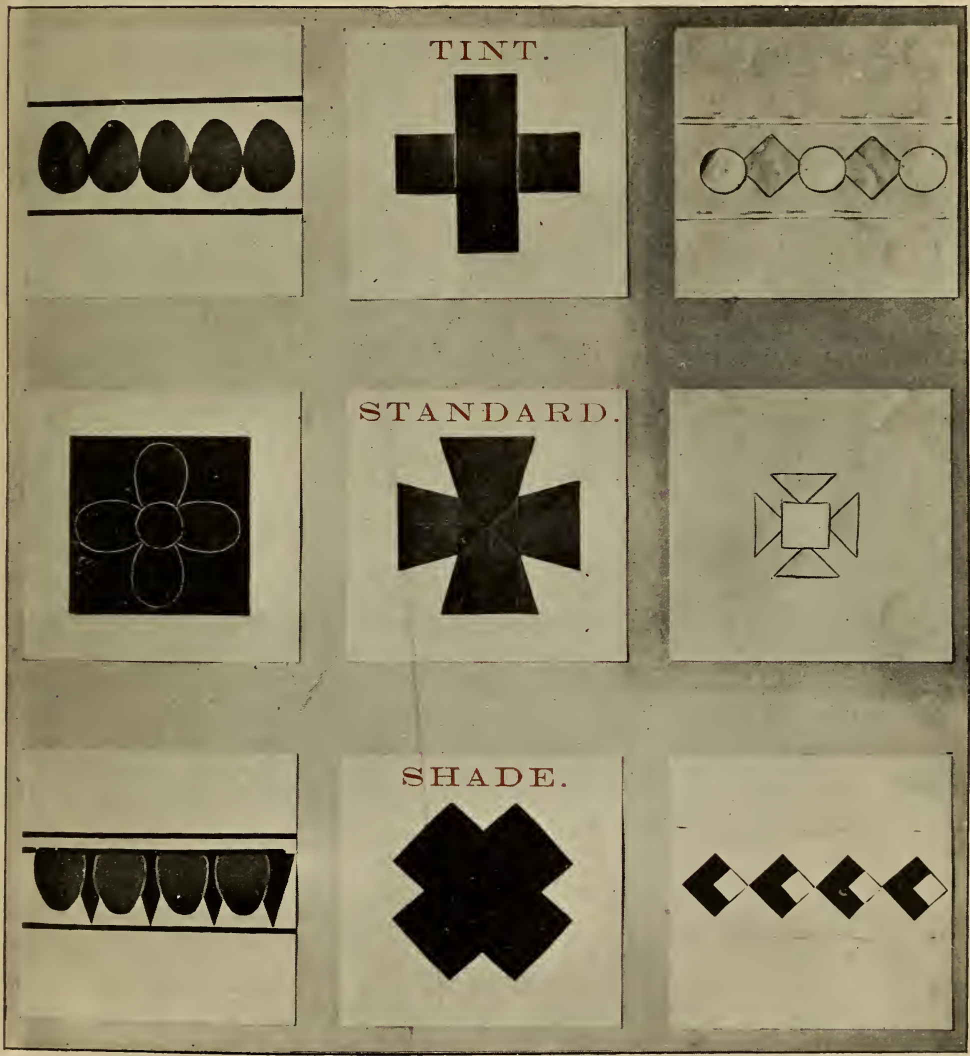
Red. Red-orange. Orange.

Plate XXX.



Orange-yellow. Yellow. Yellow-green.

Plate XXXI.

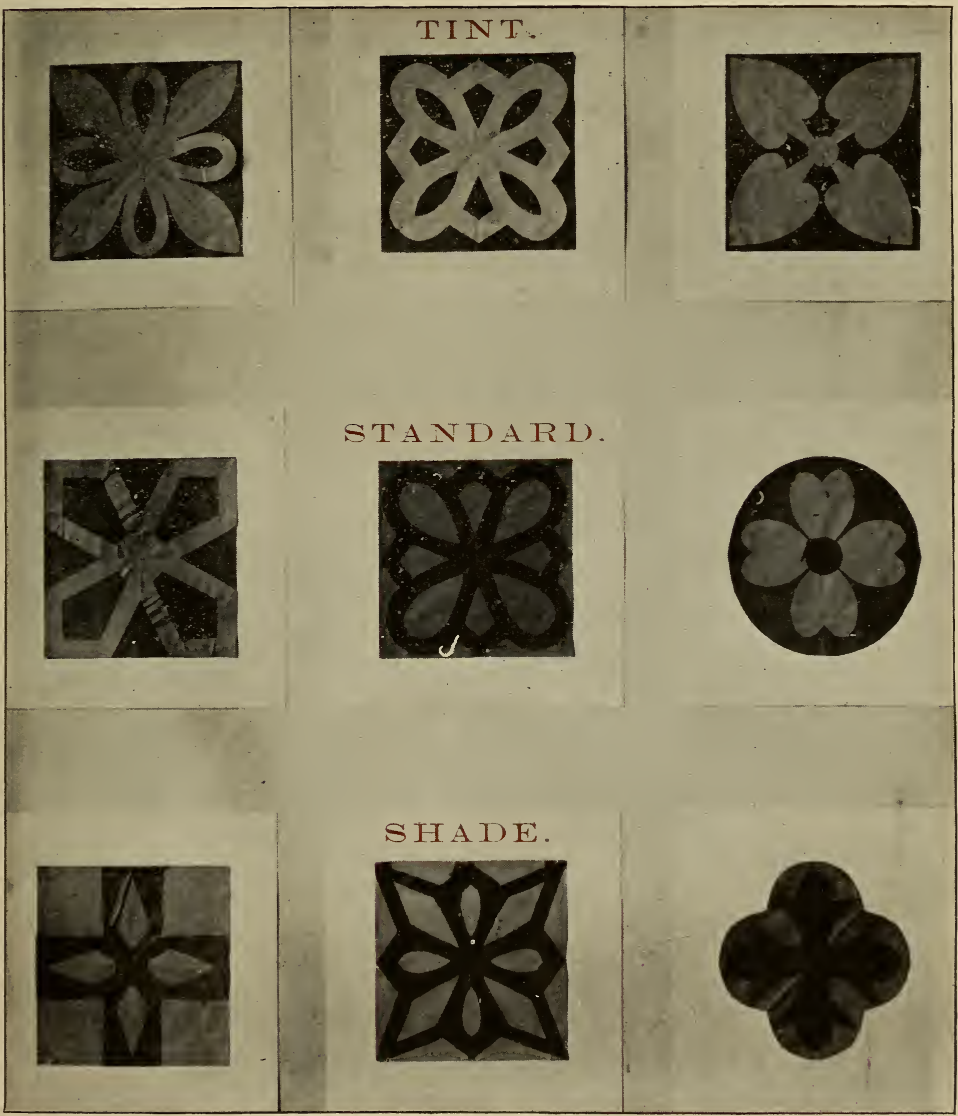


Green. Green-blue. Blue.

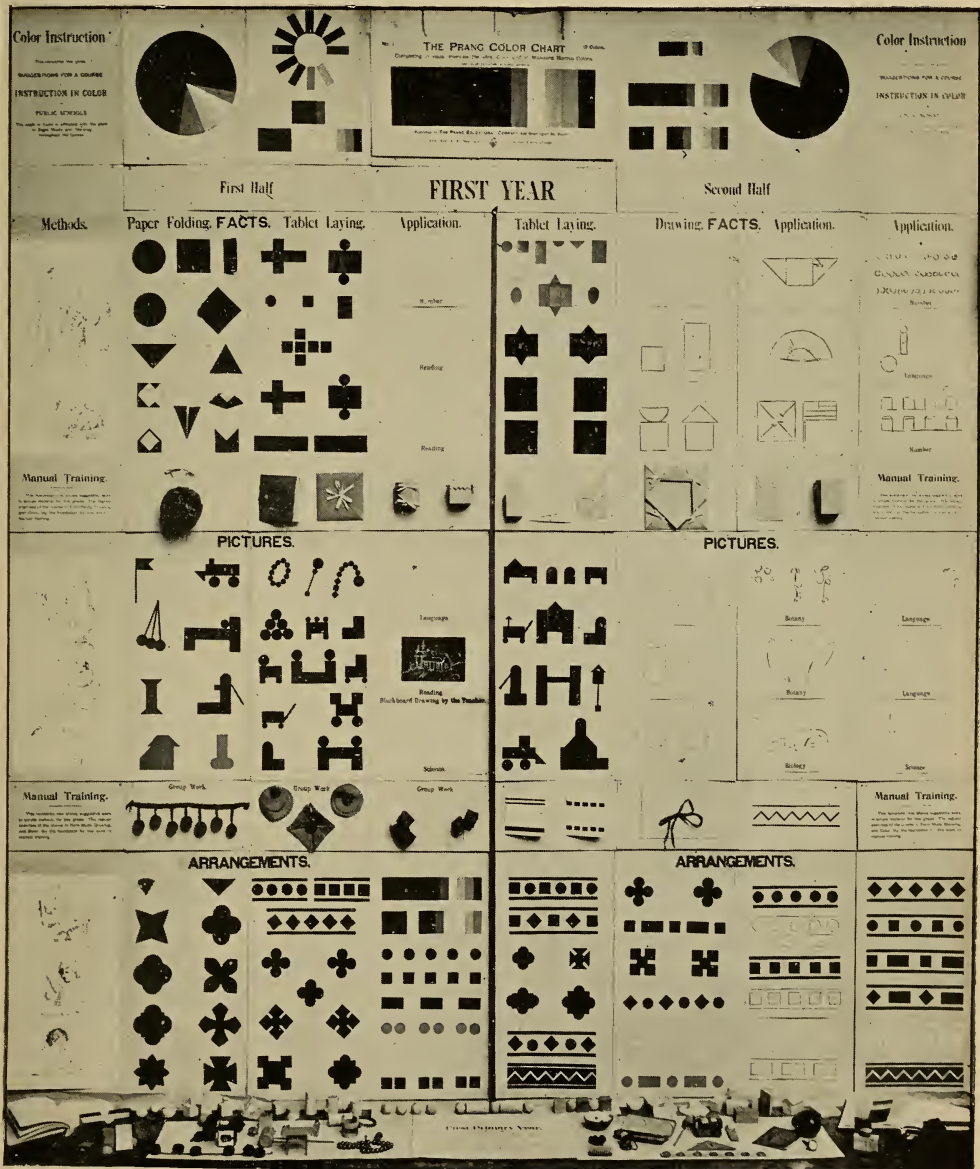
Plate XXXII.

Blue-violet. Violet. Violet-red.

Plate XXXIII.



Tertiary Colors.



Color Instruction
INSTRUCTION IN COLOR
THE PRANG COLOR CHART
Color Instruction
First Half
FIRST YEAR
Second Half
Methods.
Paper Folding. FACTS. Tablet Laying.
Application.
Tablet Laying.
Drawing. FACTS. Application.
Application.
Manual Training.
PICTURES.
PICTURES.
Manual Training.
ARRANGEMENTS.
ARRANGEMENTS.

Plate XXXIV.

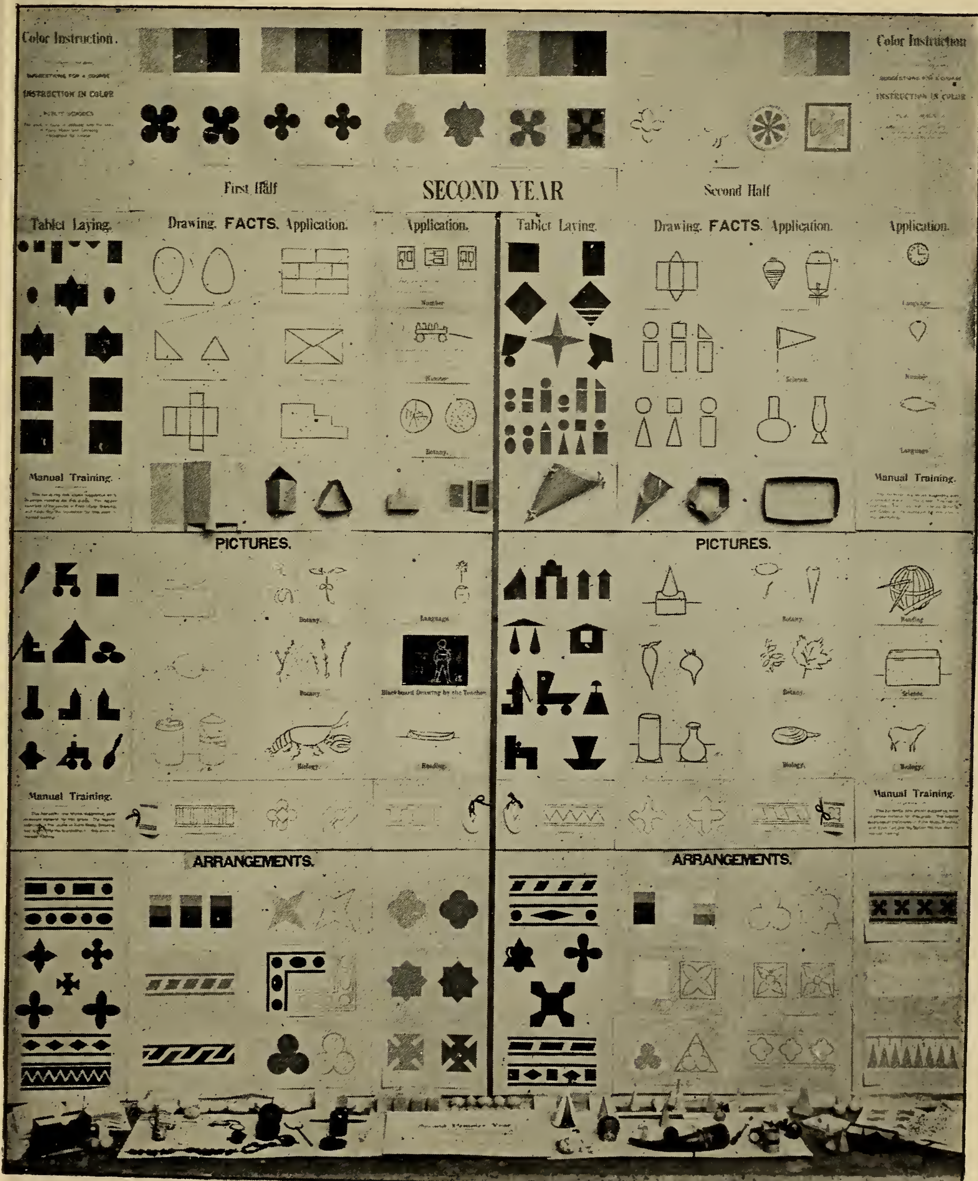

Color Instruction.
Color Instruction
First Half
SECOND YEAR
Second Half
Tablet Laying.
Drawing. FACTS. Application.
Application.
Tablet Laying.
Drawing. FACTS. Application.
Application.
Manual Training.
Manual Training.
PICTURES.
PICTURES.
Manual Training.
Manual Training.
ARRANGEMENTS.
ARRANGEMENTS.

Plate XXXV.

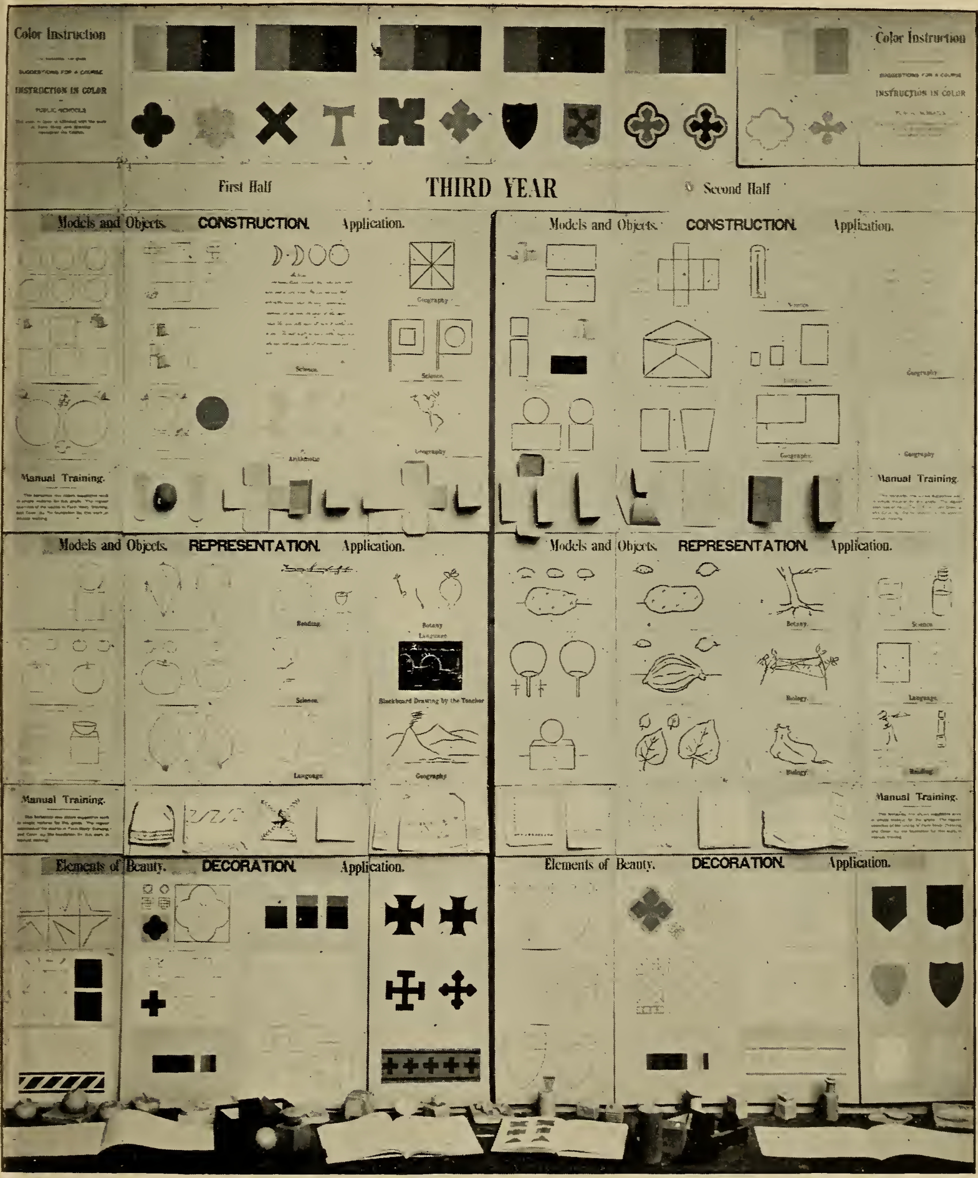
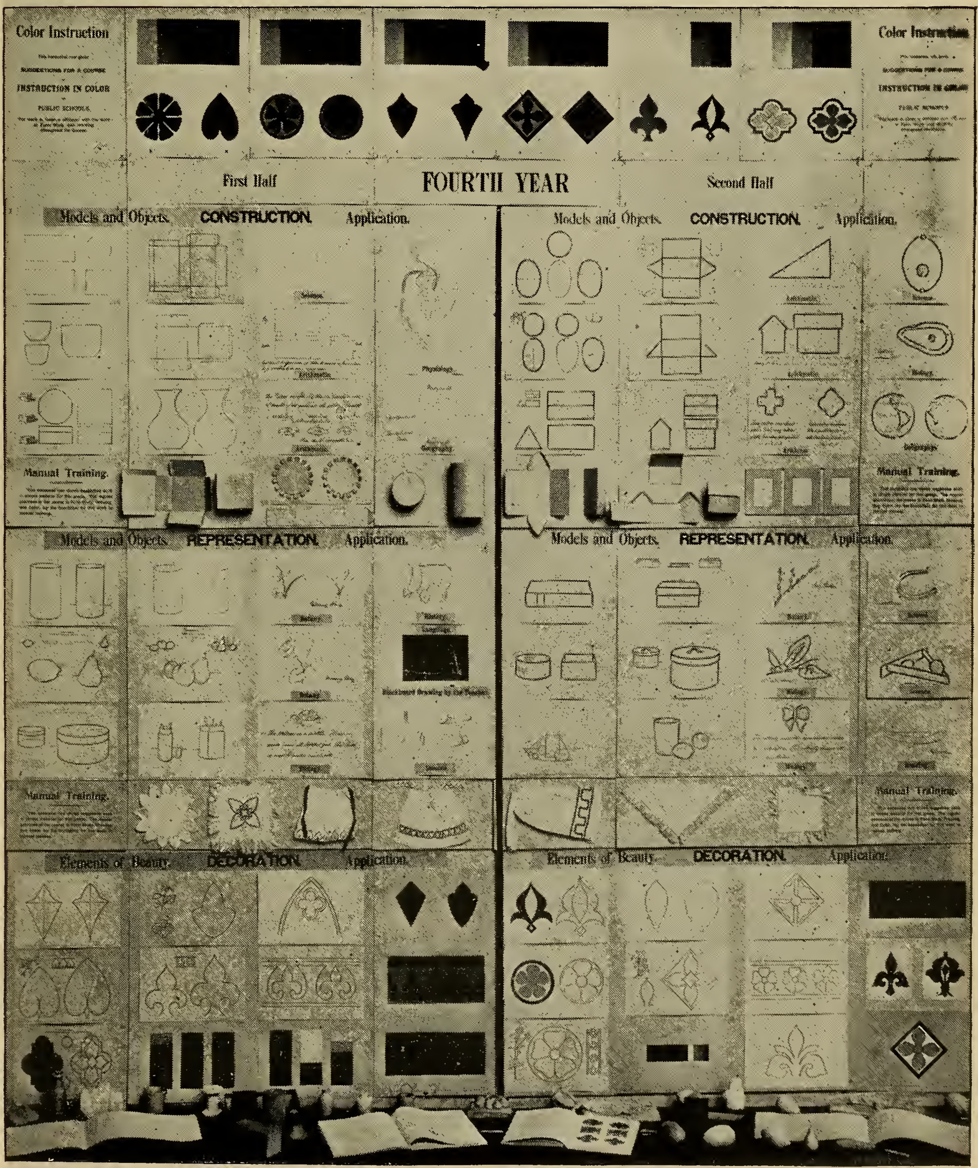

Color Instruction
INSTRUCTION IN COLOR
Color Instruction
First Half
THIRD YEAR
Second Half
Models and Objects.
CONSTRUCTION.
Application.
Models and Objects.
CONSTRUCTION.
Application.
Manual Training.
Manual Training.
Models and Objects.
REPRESENTATION.
Application.
Models and Objects.
REPRESENTATION.
Application.
Blackboard Drawing by the Teacher
Manual Training.
Manual Training.
Elements of Beauty.
DECORATION.
Application.
Elements of Beauty.
DECORATION.
Application.

Plate XXXVI.



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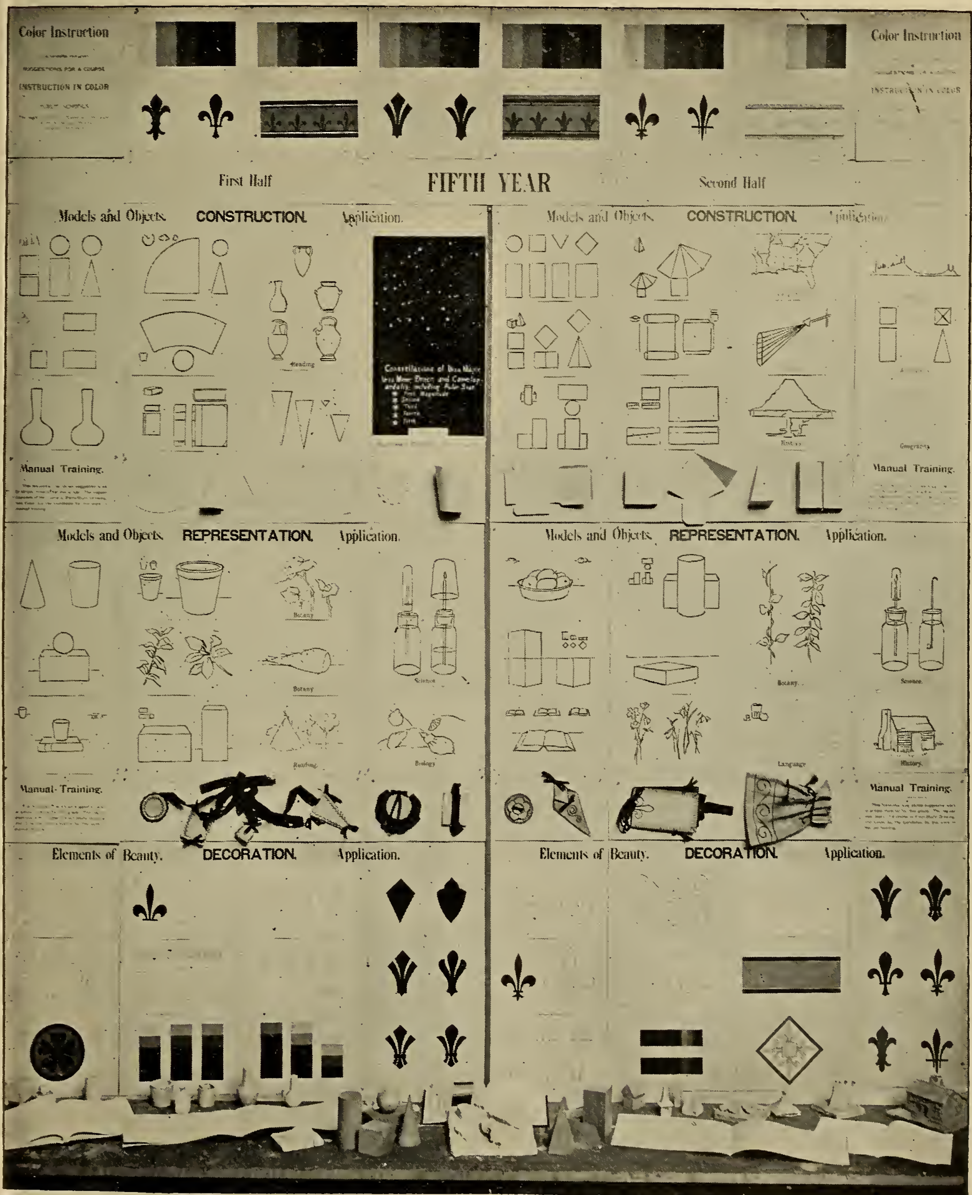


Plate XXXVIII.

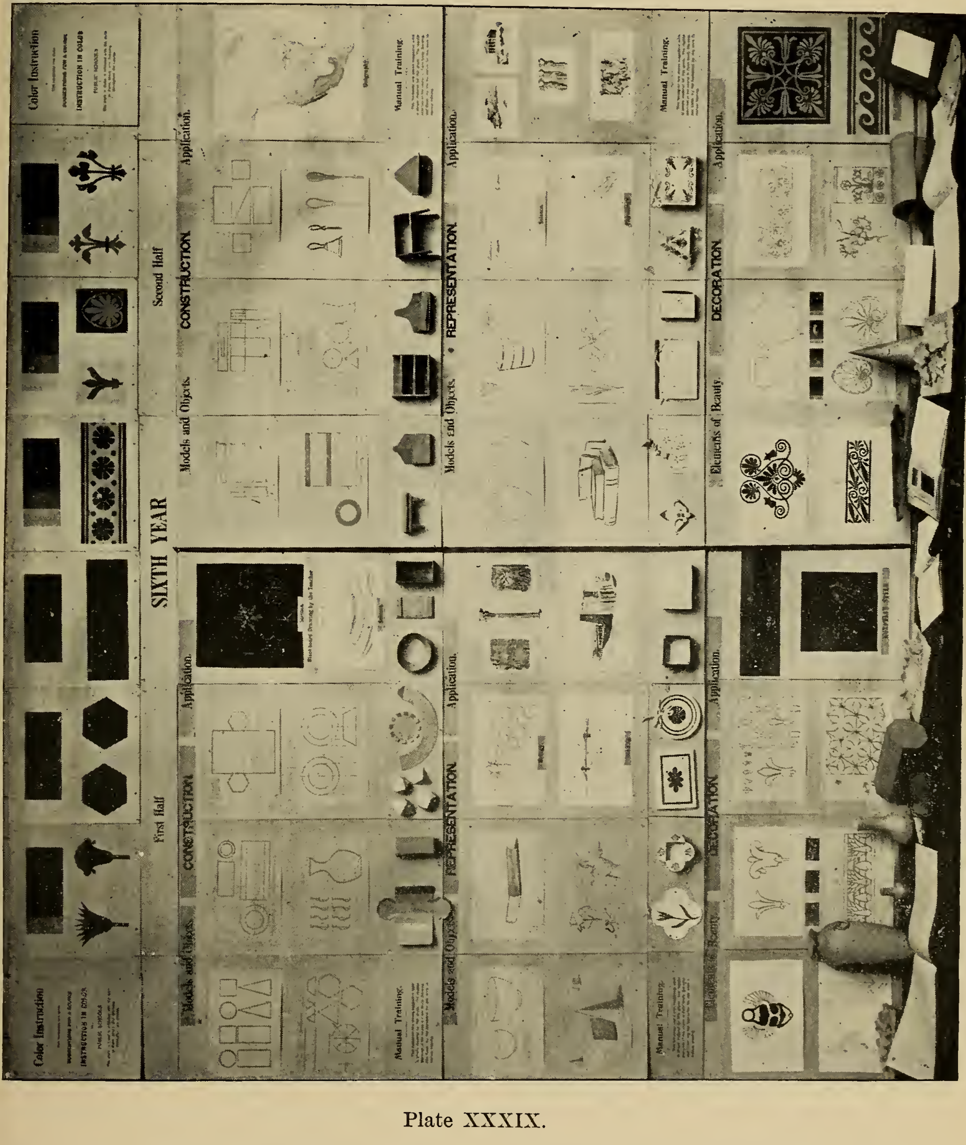

SIXTH YEAR
First Half
Second Half
Color Instruction
Models and Objects
CONSTRUCTION
Application
REPRESENTATION
Manual Training
Elements of Beauty
DECORATION

Plate XXXIX.

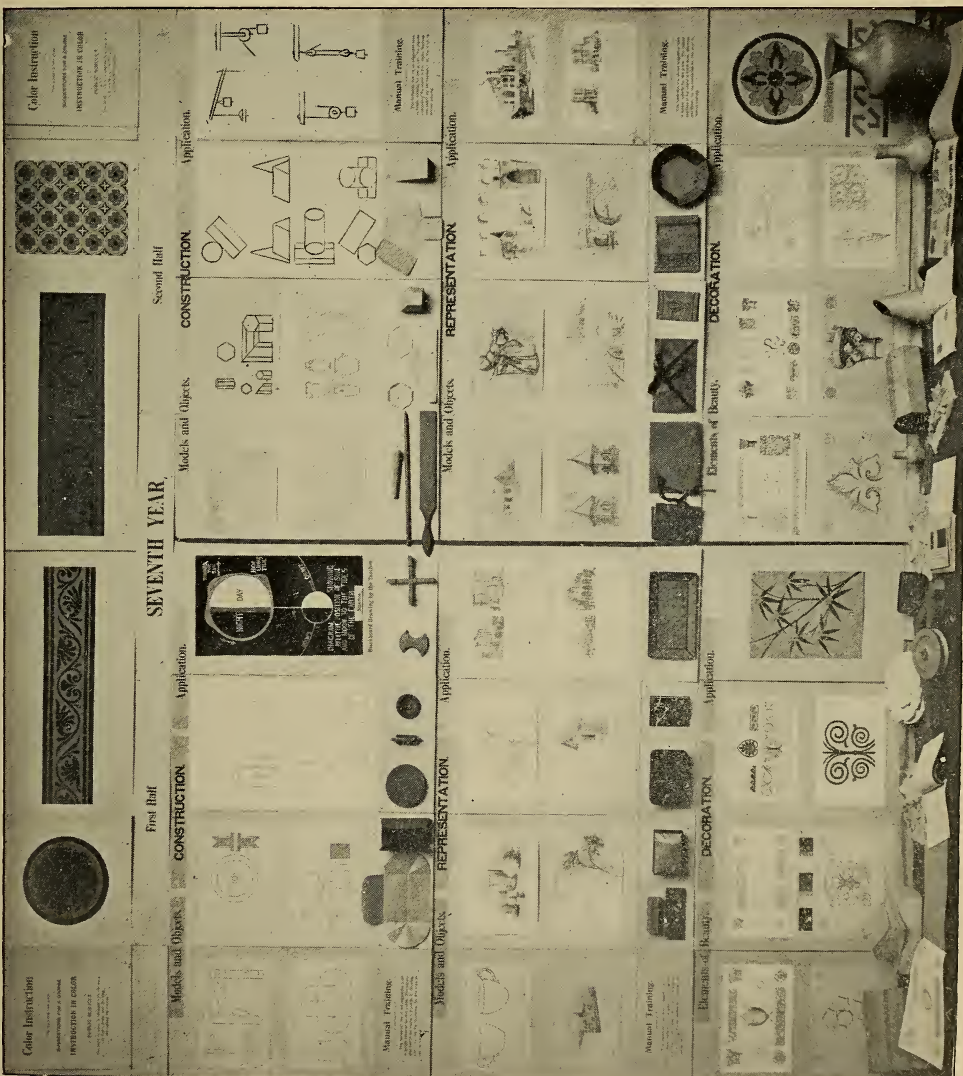

SEVENTH YEAR
First Half
Second Half
Color Instruction
INSTRUCTION IN COLOR
Models and Objects
CONSTRUCTION
Application
REPRESENTATION
DECORATION
Elements of Beauty
Manual Training

Plate XL.


Color Instruction
EIGHTH YEAR
First Half
Second Half
Models and Objects.
CONSTRUCTION
Application.
Manual Training.
REPRESENTATION
DECORATION
Elements of Beauty.

Plate XLI.

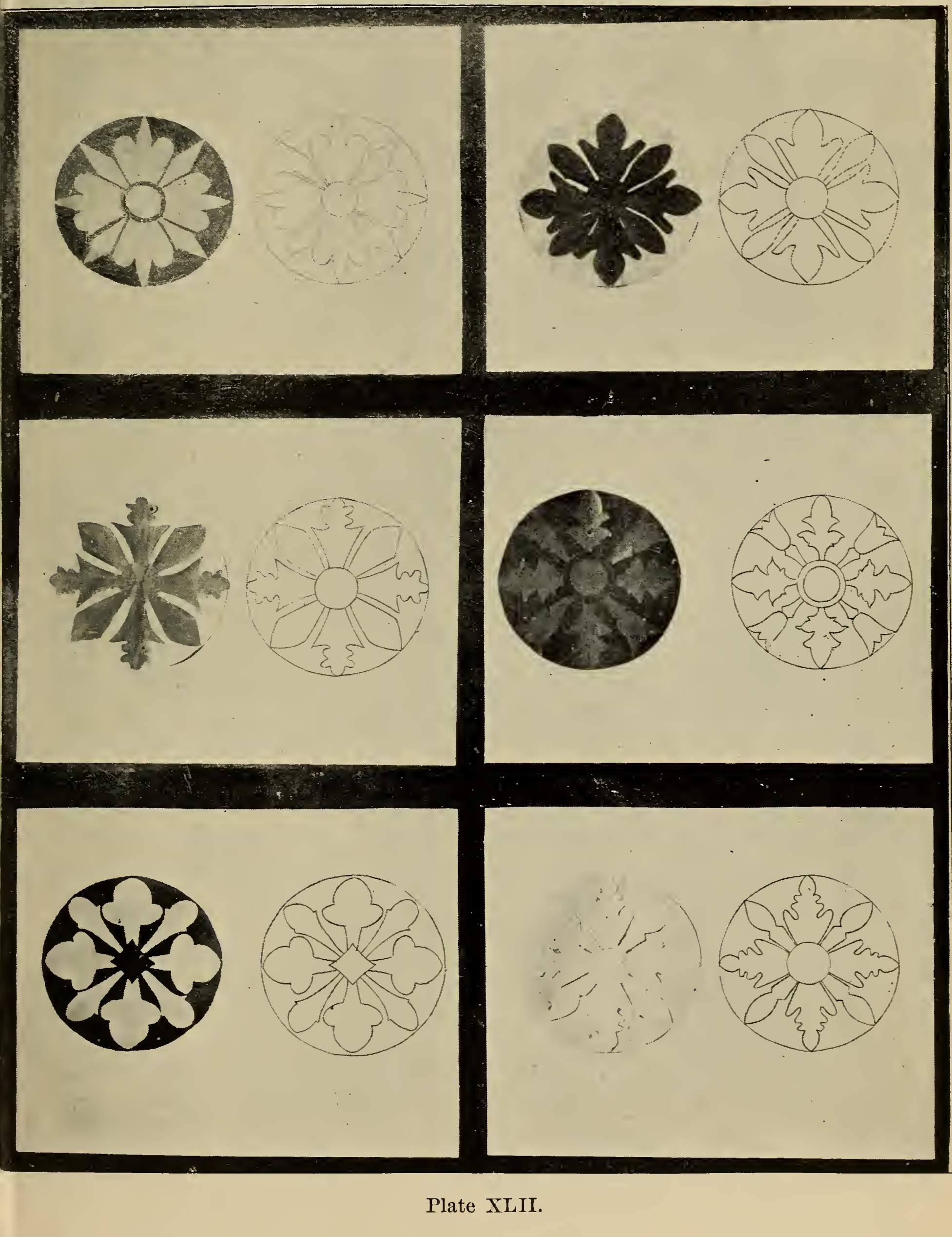


Plate XLII.

Plate XLIII.

Plate XLIII.

Plate XLIV.

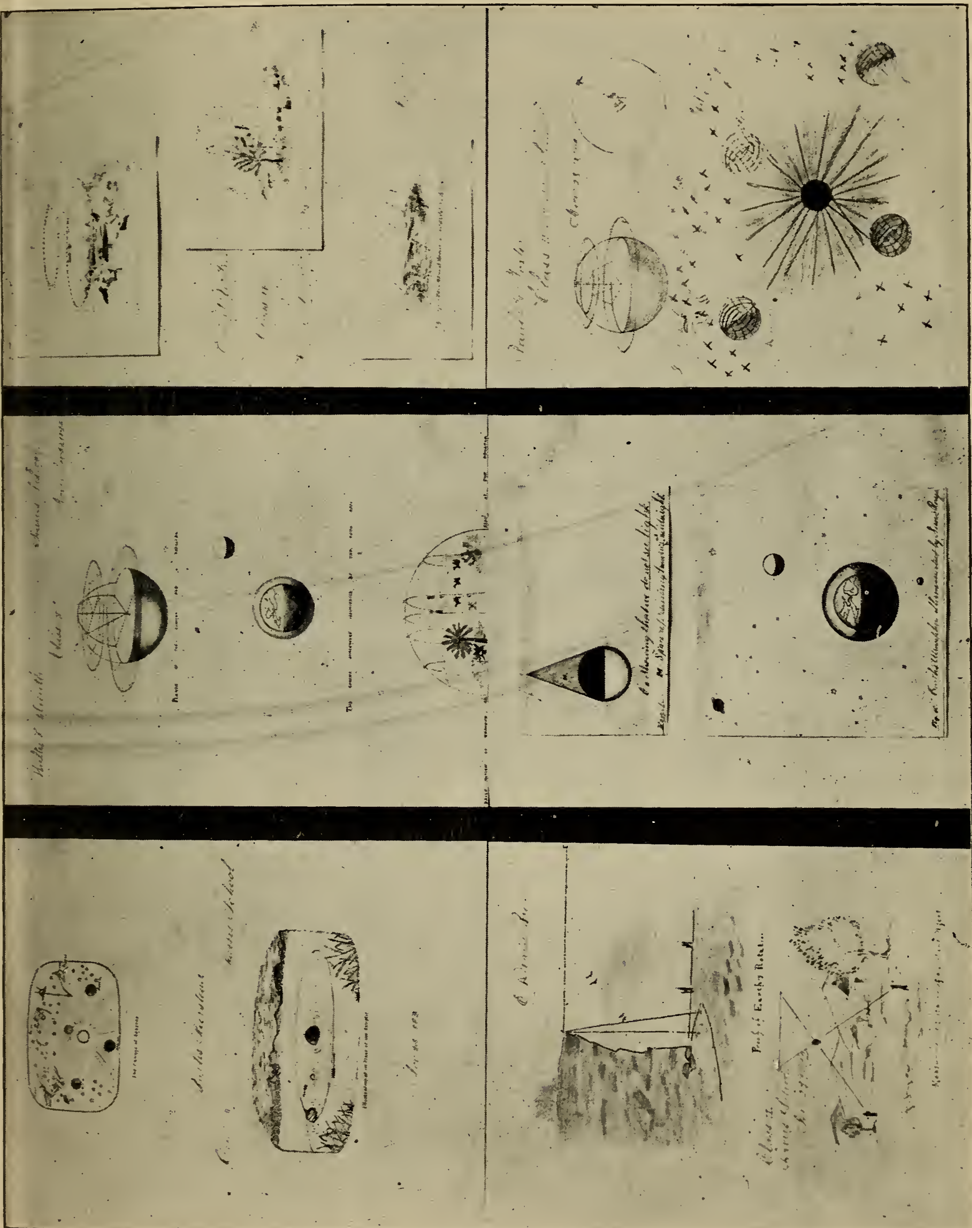


Plate XLV.

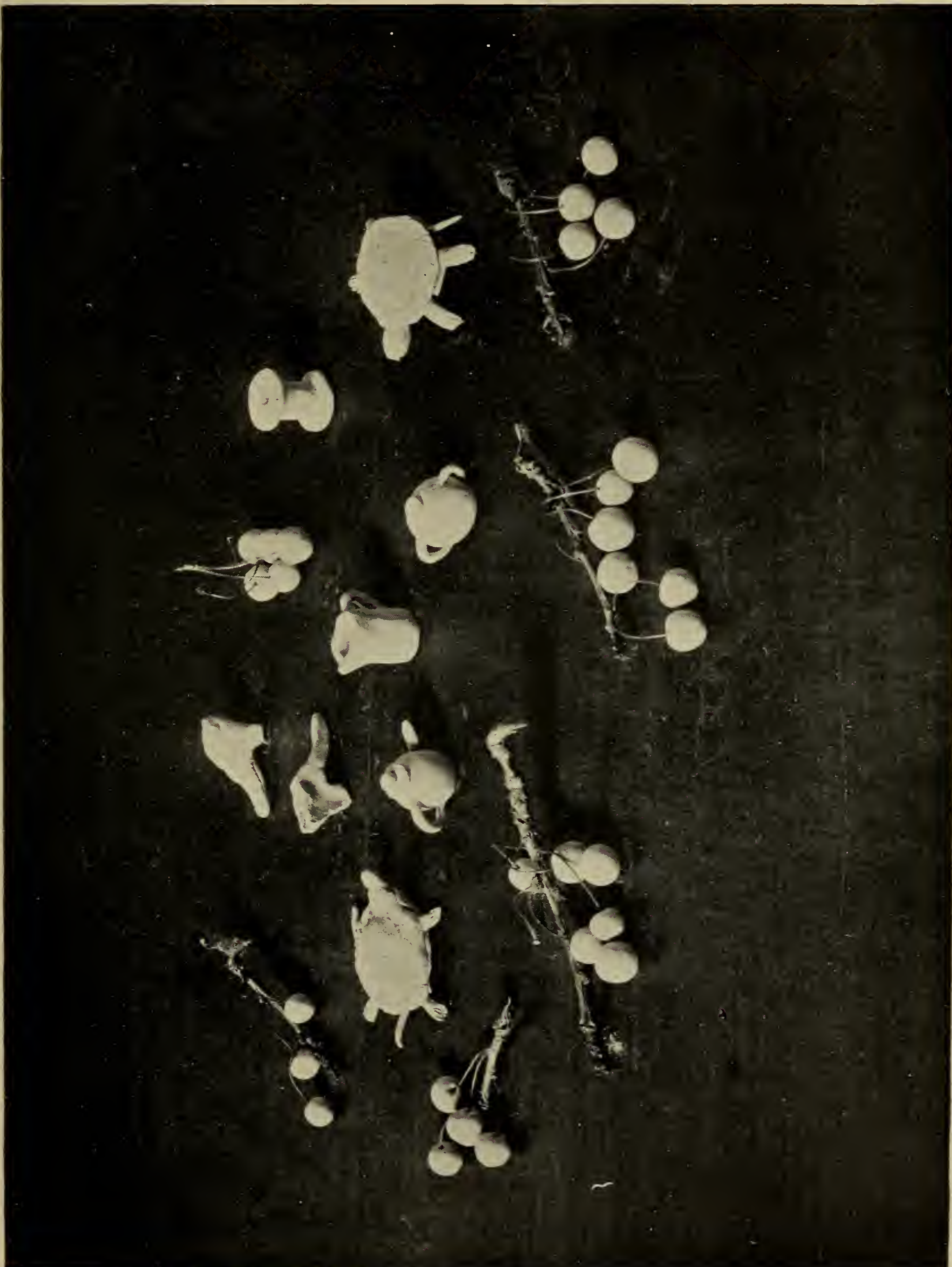
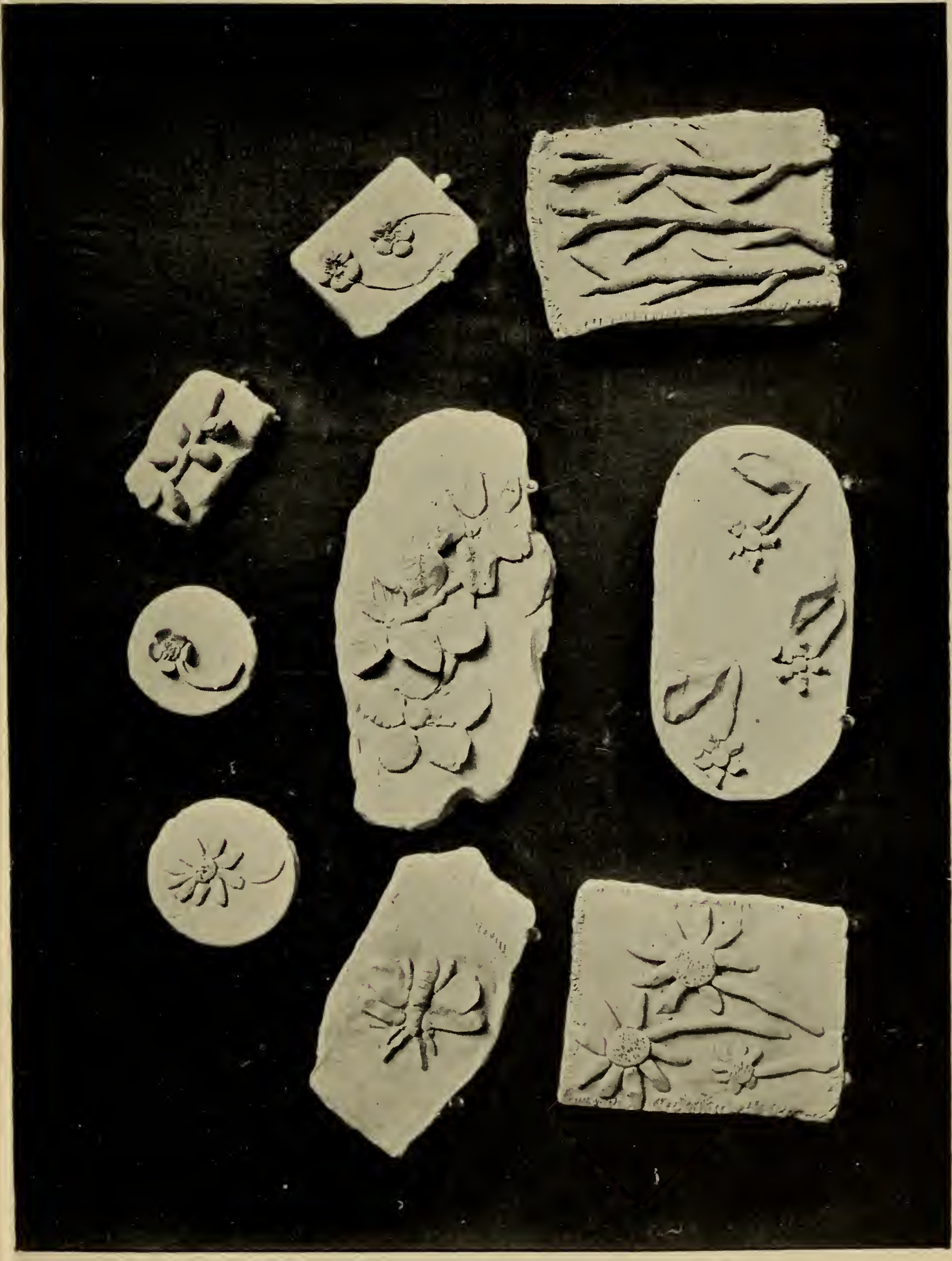


Plate XLVI.



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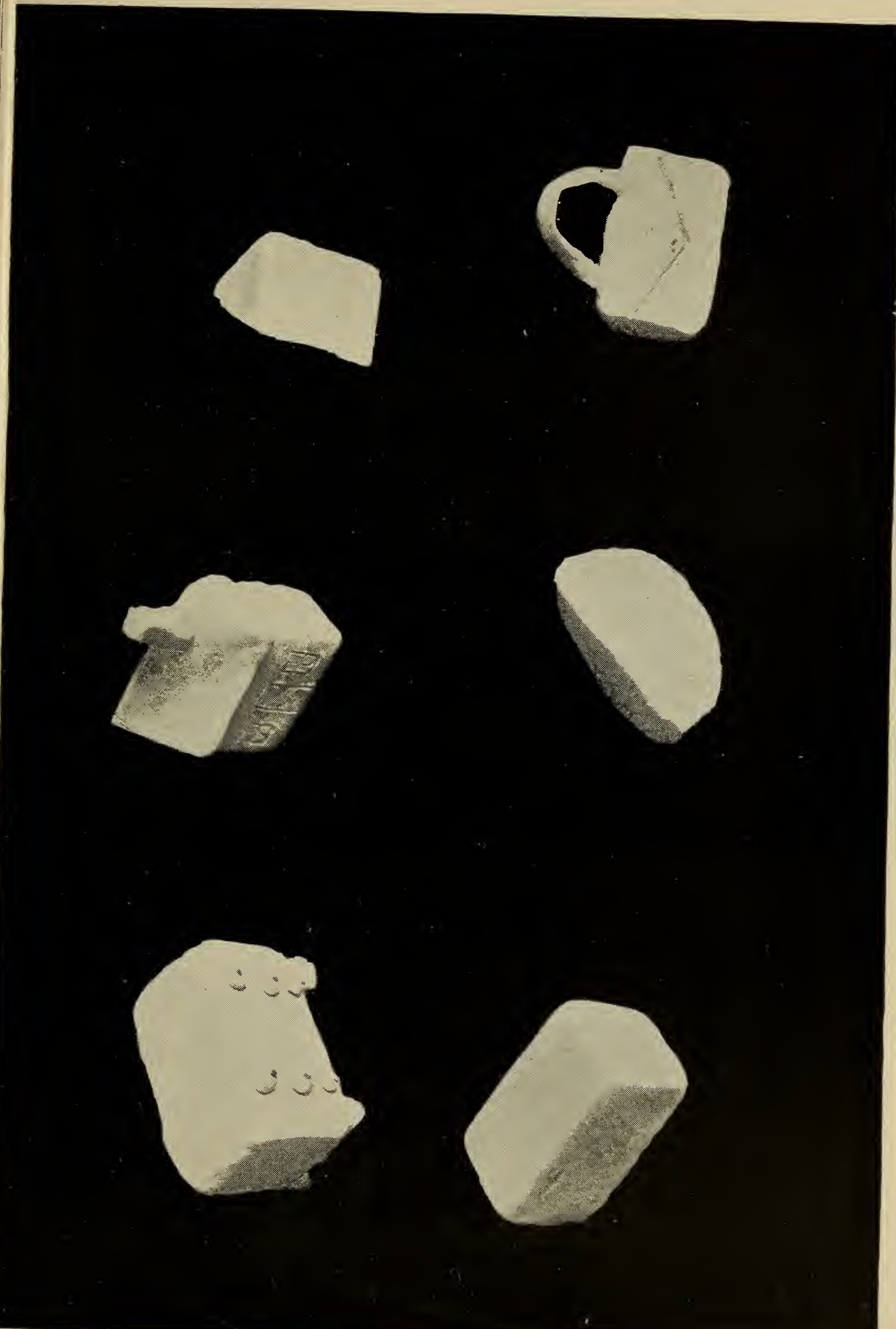


Plate XLVIII.

Plate XLIX.

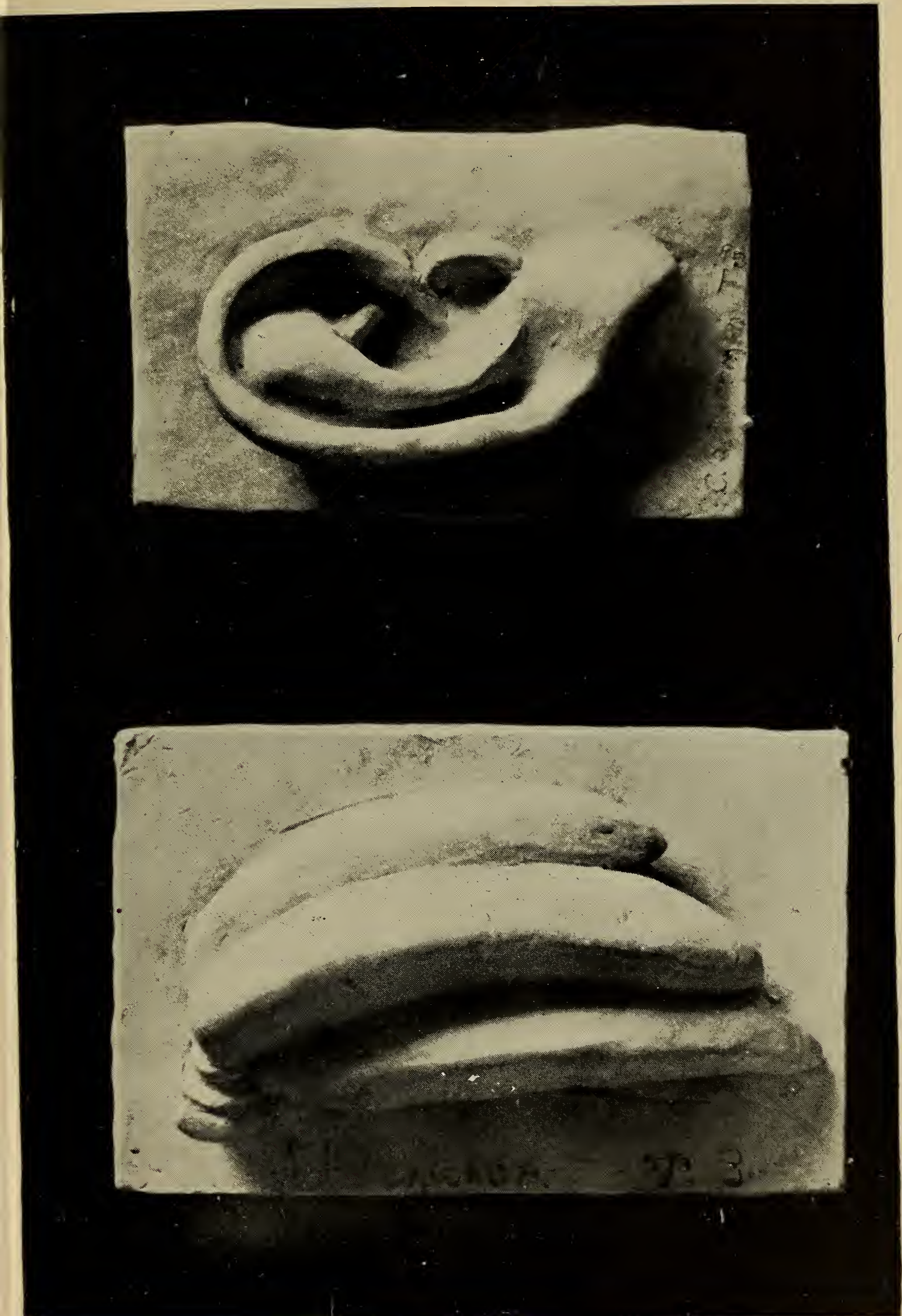
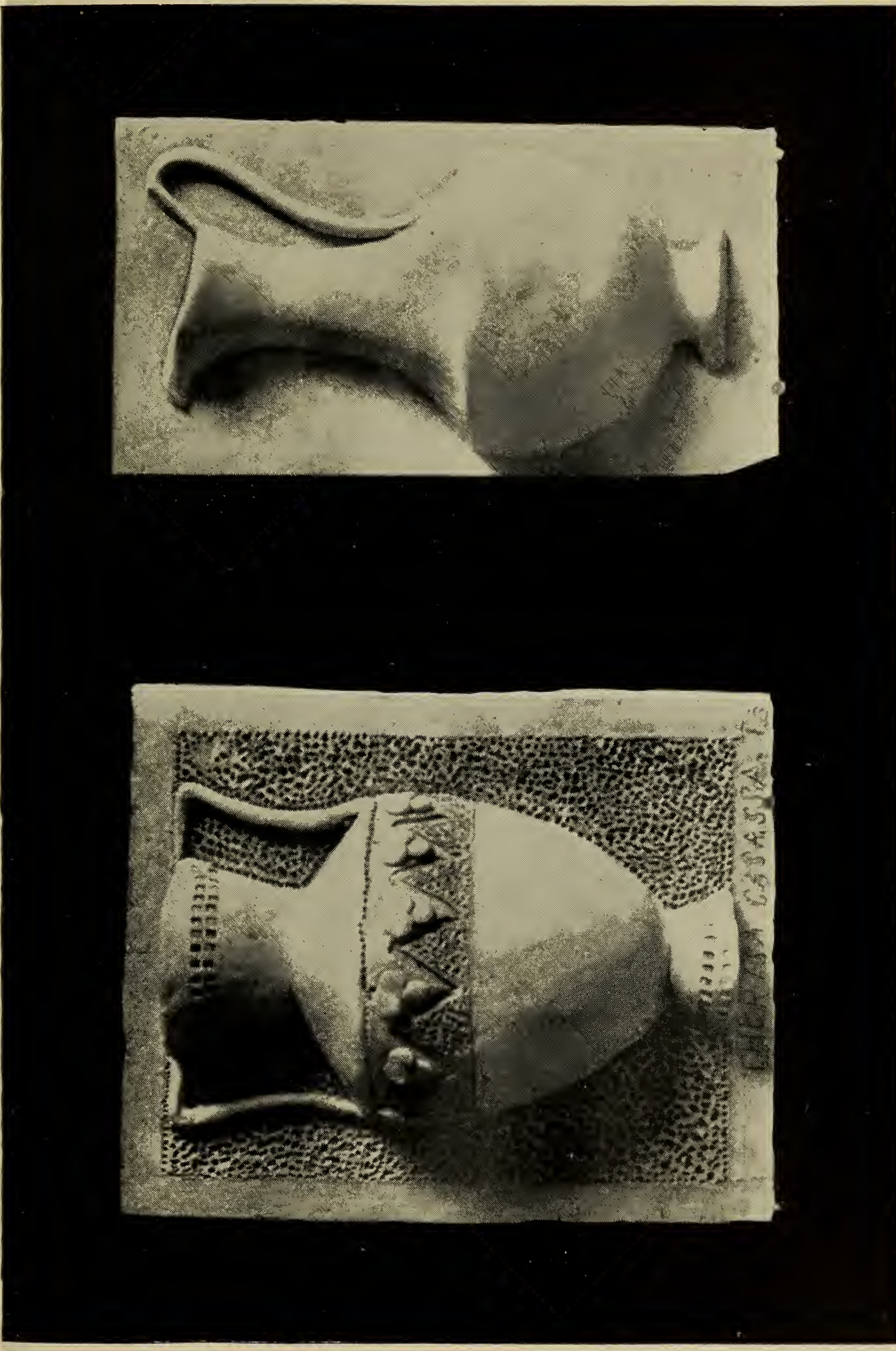


Plate L.



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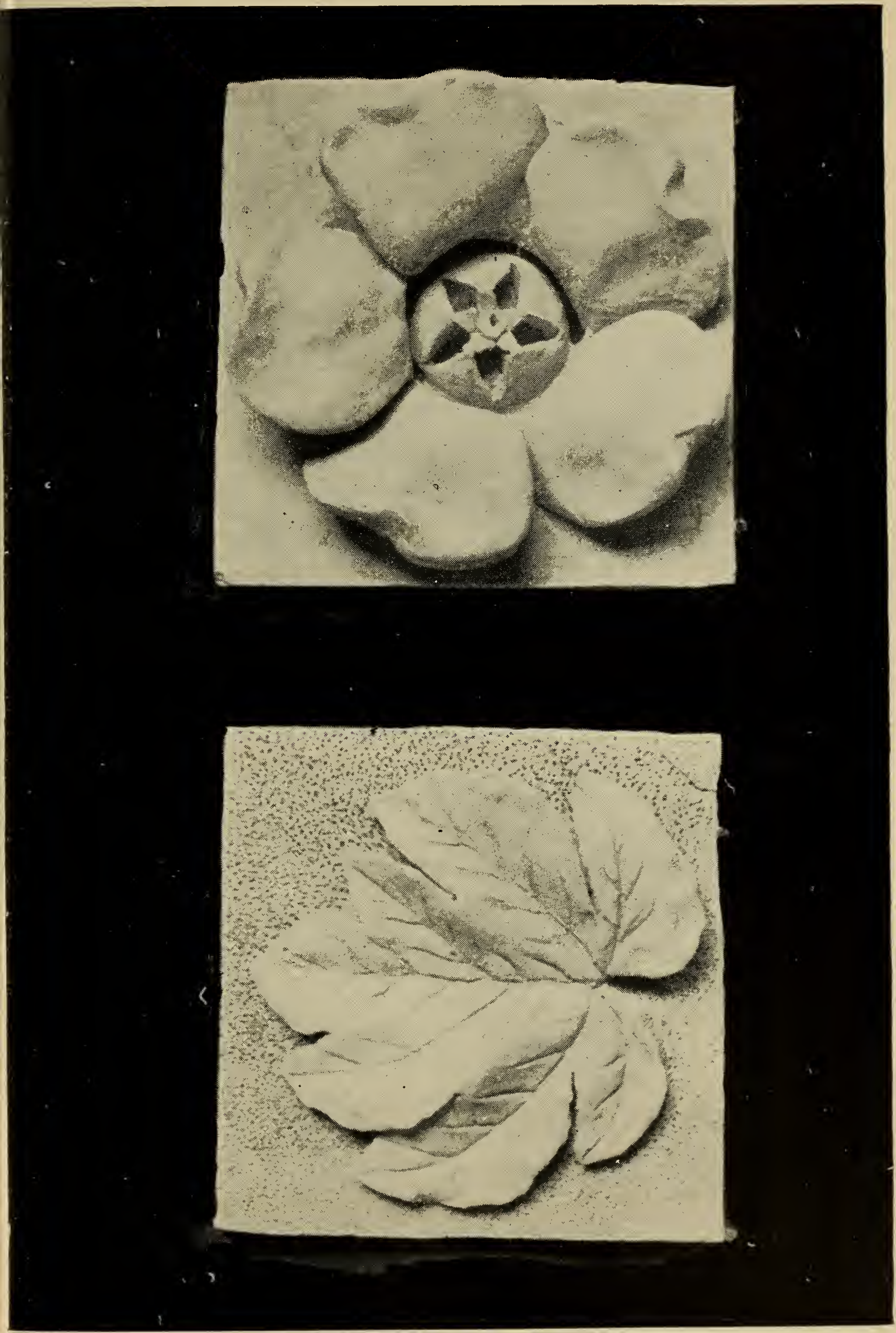

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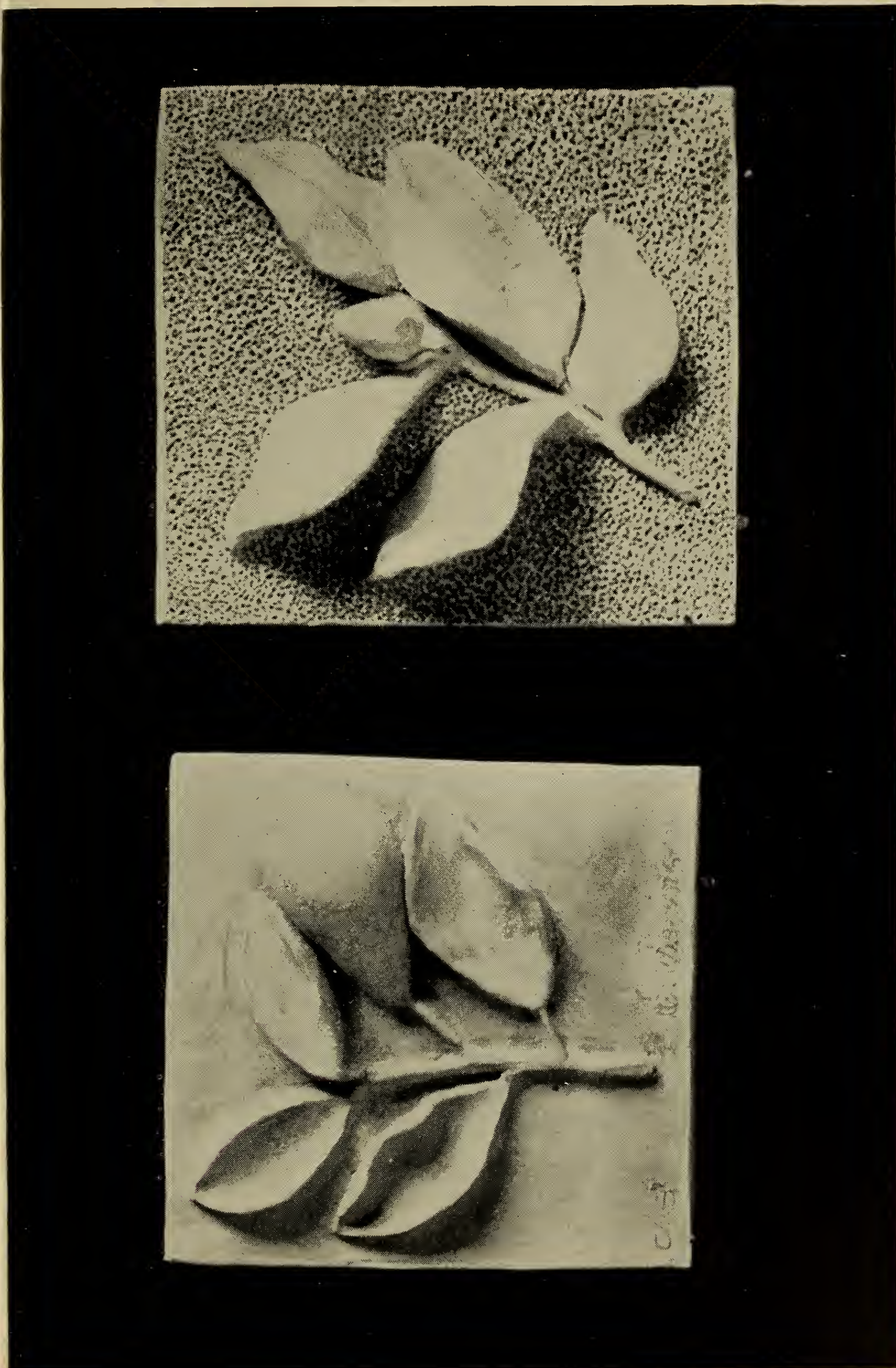

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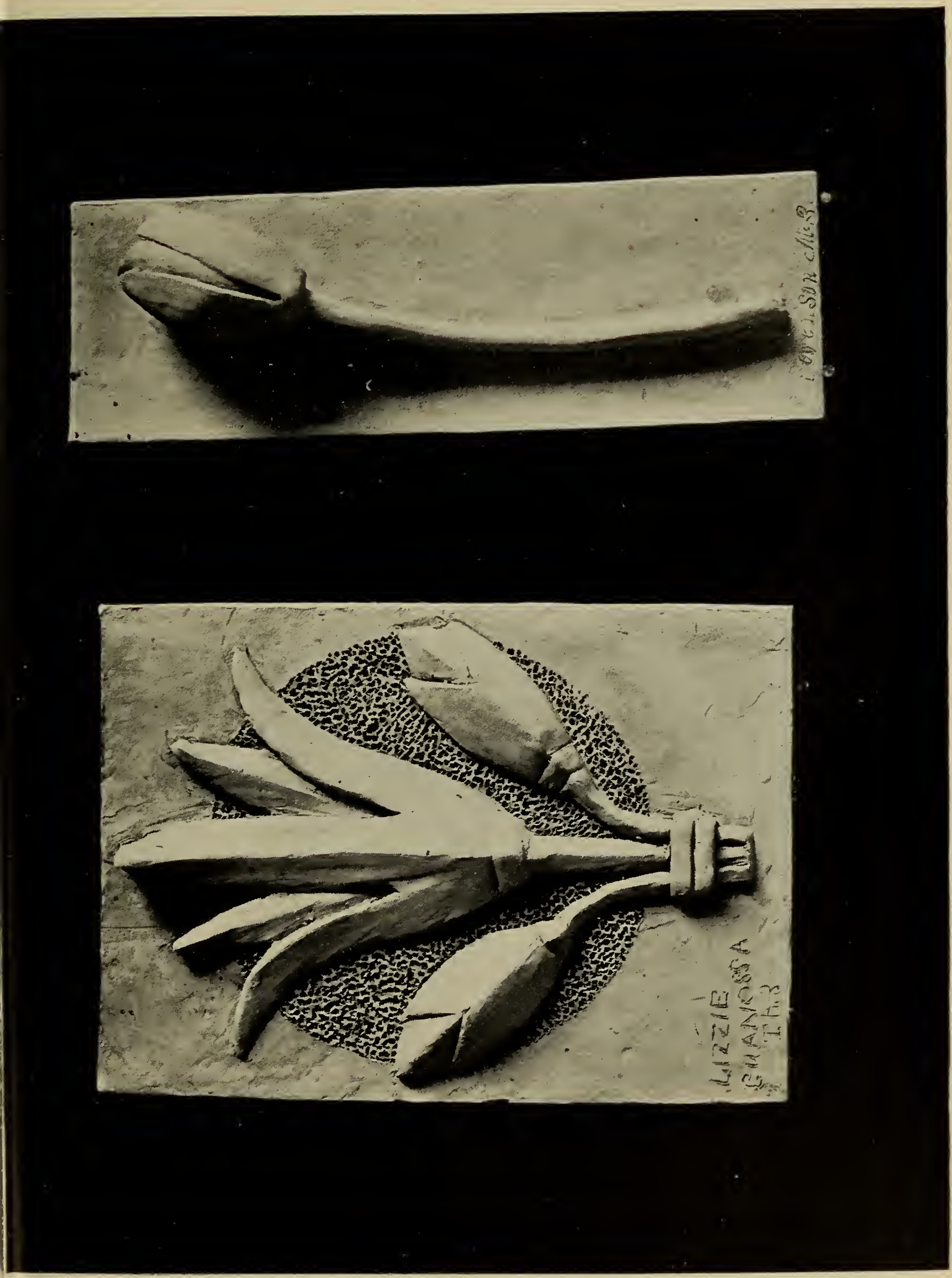

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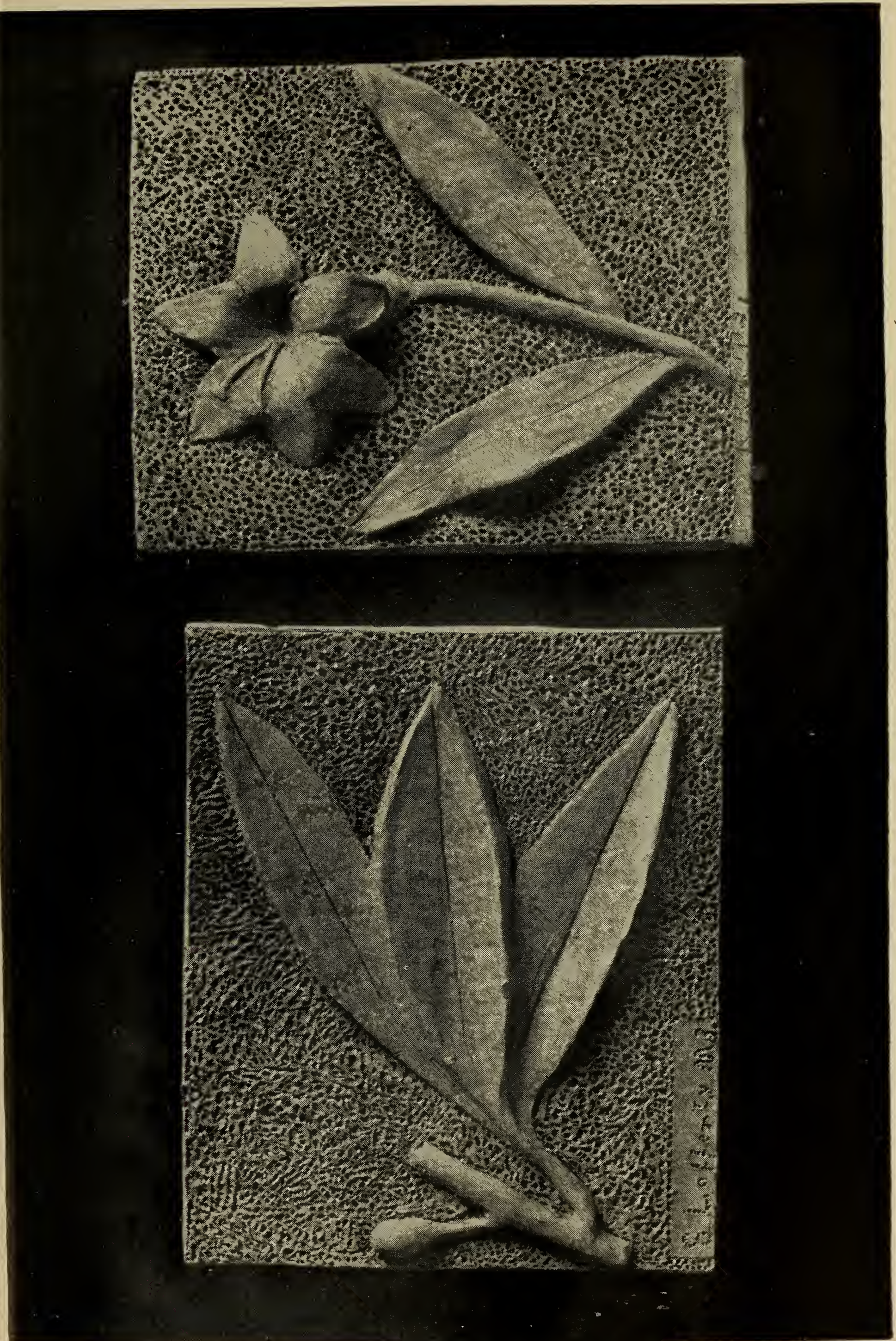

Plate LV.

Plate LVI.

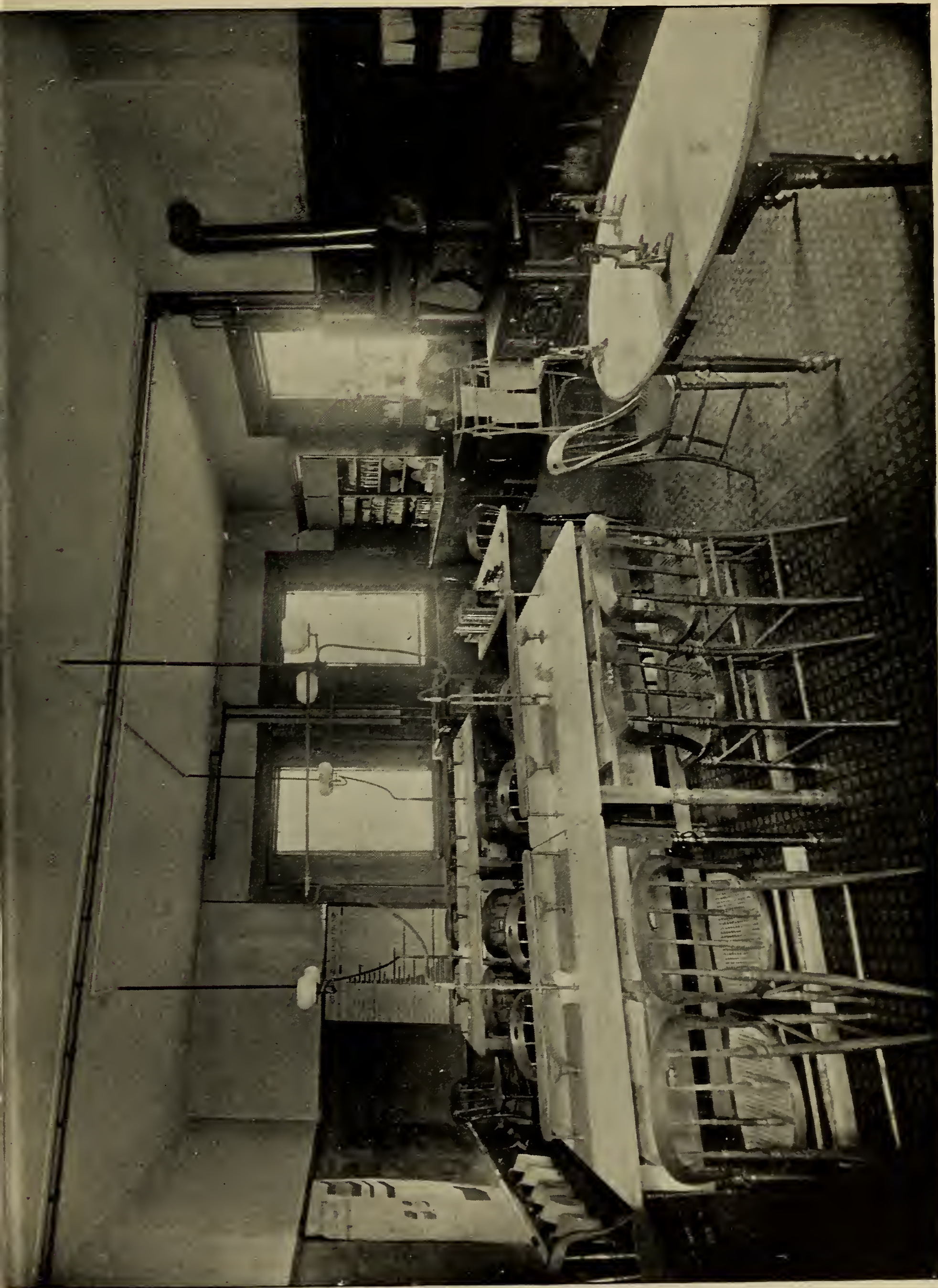

Plate LVII.

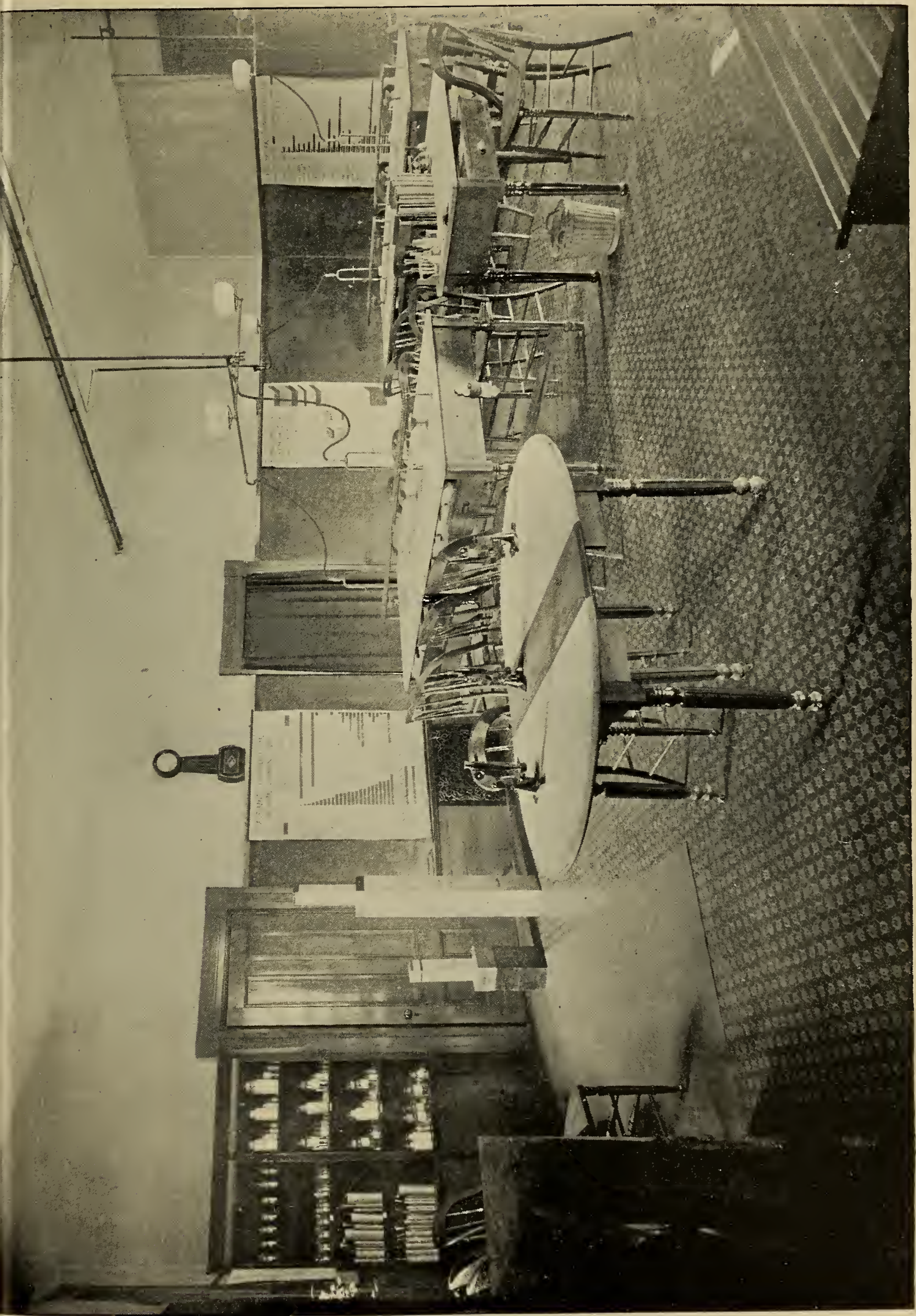

Plate LVIII.

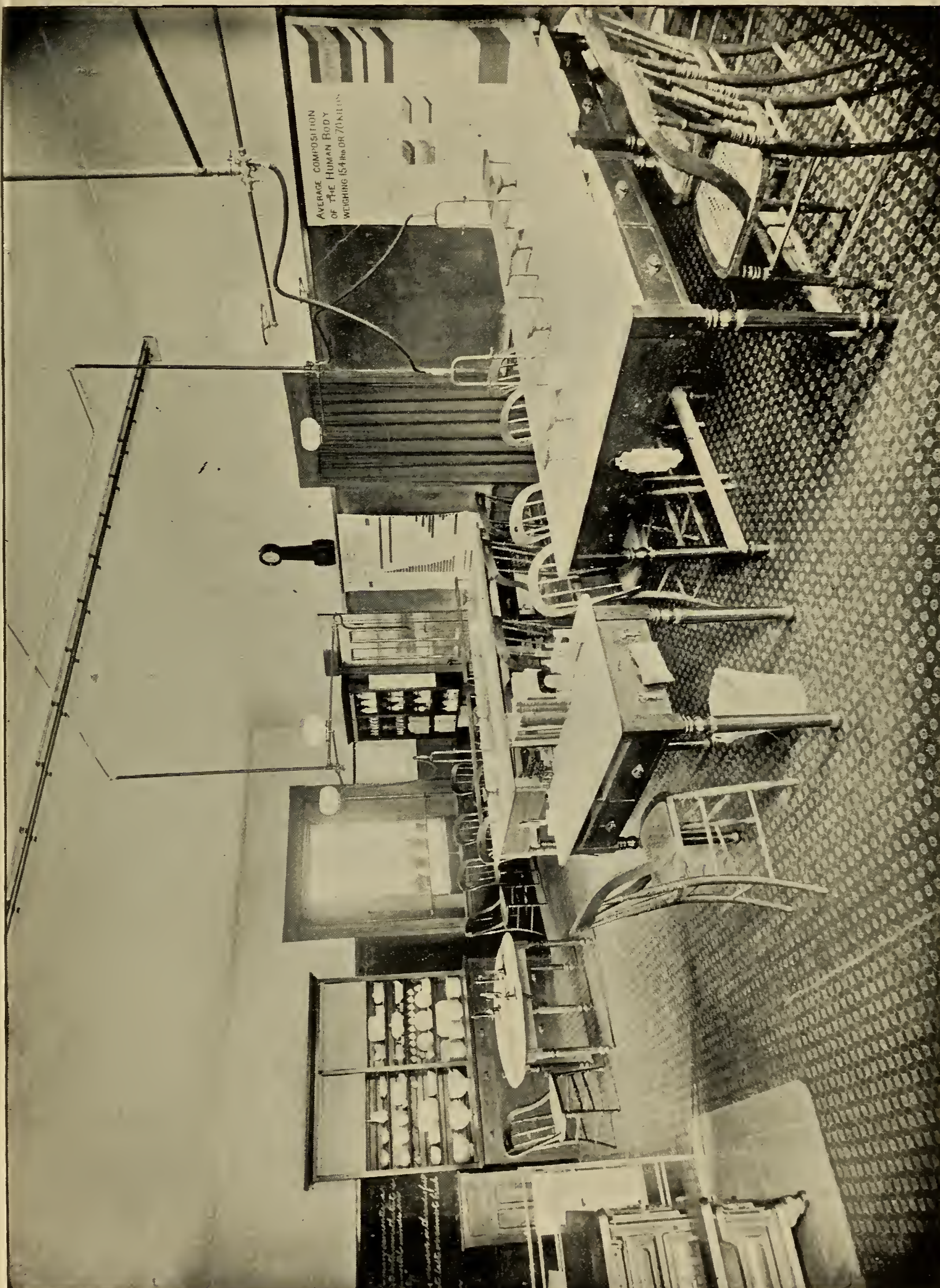

Plate LIX.

Plate LX.

Plate LXI.

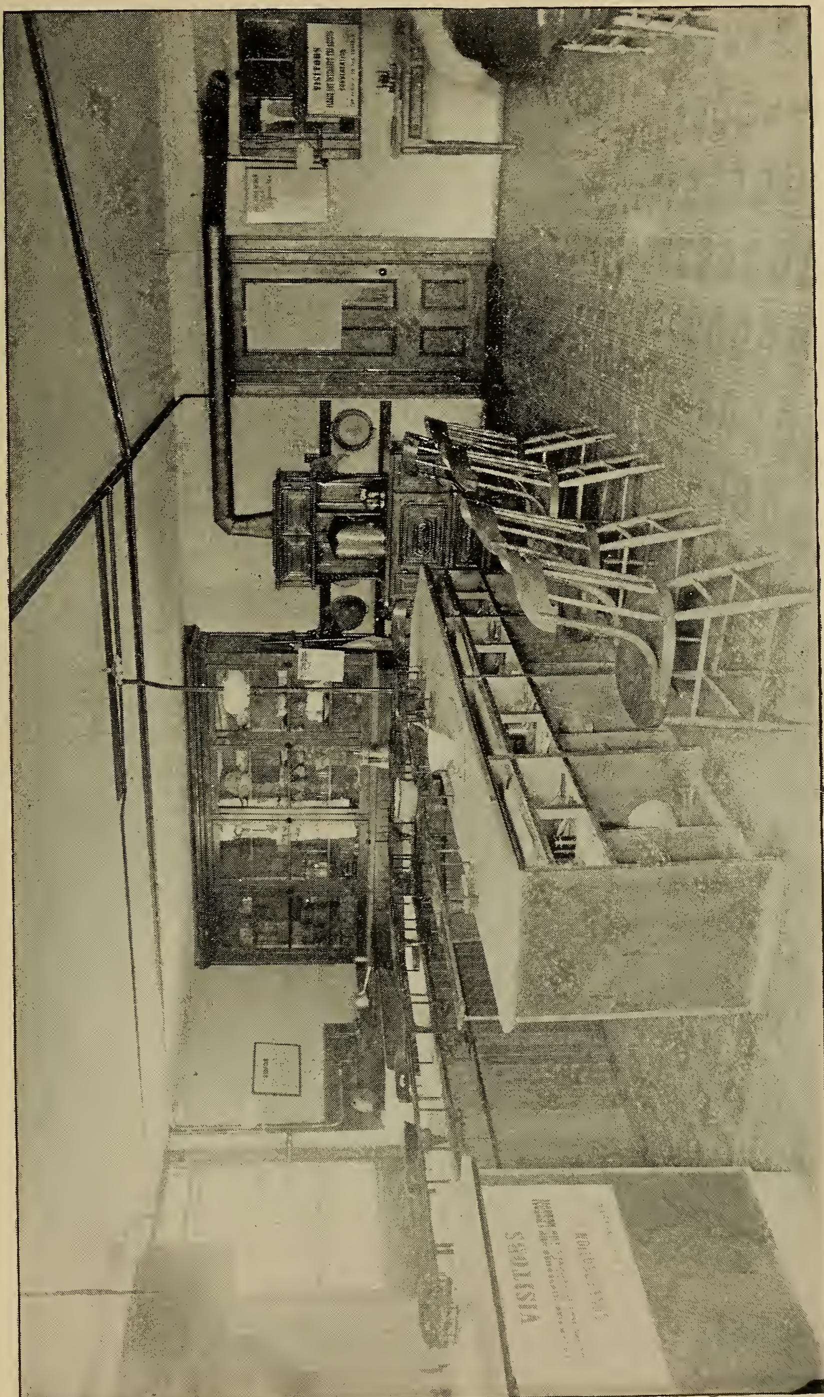

Plate LXII.

Plate LXIII. Cooking Class, Boston.

Plate LXIV. COOKING CLASS, BROOKLINE.

Plate LXV. Sewing and Dress-fitting, Boston.

Plate LXVI. Draughting and Cutting, Brookline.

Plate LXVII. Cardboard Construction, Boston.

Plate LXVIII. Clay Modelling, Boston.

Plate LXIX. Kindergarten, Boston.

Plate LXX. Kindergarten, Brookline.

Plate LXXI.

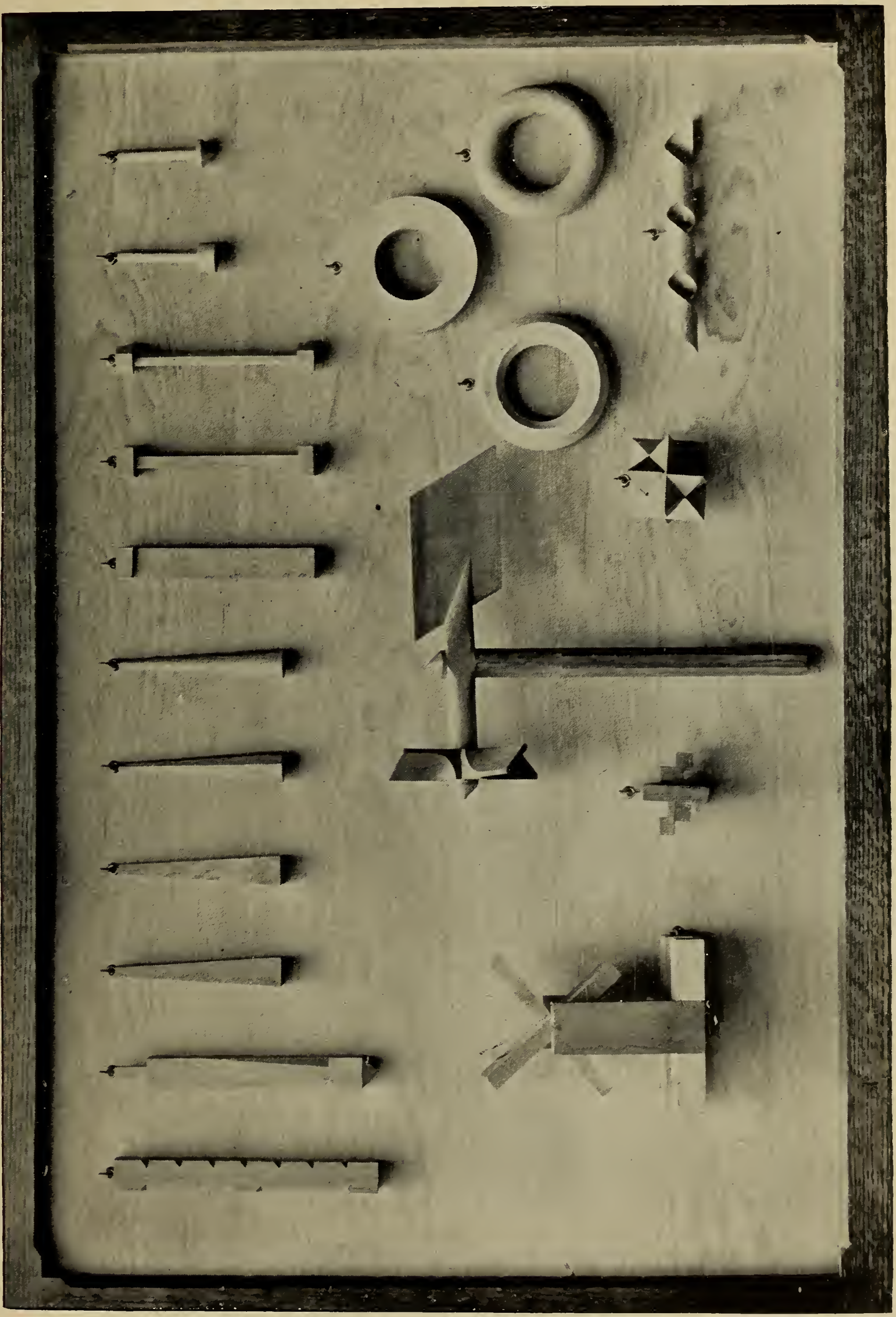

Plate LXXII.

Plate LXXIII.

PHOTOGRAPHS.

Plates XVI.–XXV., Kindergarten Occupations.

Plates XXVI.–XXXIII., Mrs. Cutler's Primary Manual Training Course.

Plates XXXIV.–XLI., Prang's Manual Training Course.

Plates XLII.–XLV., Original Designs and Applied Drawing in Grammar Schools.

Plates XLVI.–LV., Clay Modelling: Kindergarten, Primary and Grammar Grades.

Plates LVI.–LIX., Normal School of Cookery.

Plates LX., LXI., Normal Kindergarten Work.

Plates LXII.–LXX., Classes in Cooking, Sewing, Card-board Construction (Grammar), Clay Modelling (Primary) and Building (Kindergarten).

Plate LXXI., The Eva Rodhe Models.

Plate LXXII., Wood-work of New York Training College, Lowest Grammar Grades.

Plate LXXIII., Wood-work of New York Training College, Work of Normal Pupils.

APPENDIX O.

CONTRIBUTION TO THE BIBLIOGRAPHY OF MANUAL TRAINING AND INDUSTRIAL EDUCATION.

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